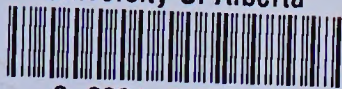


University Of Alberta

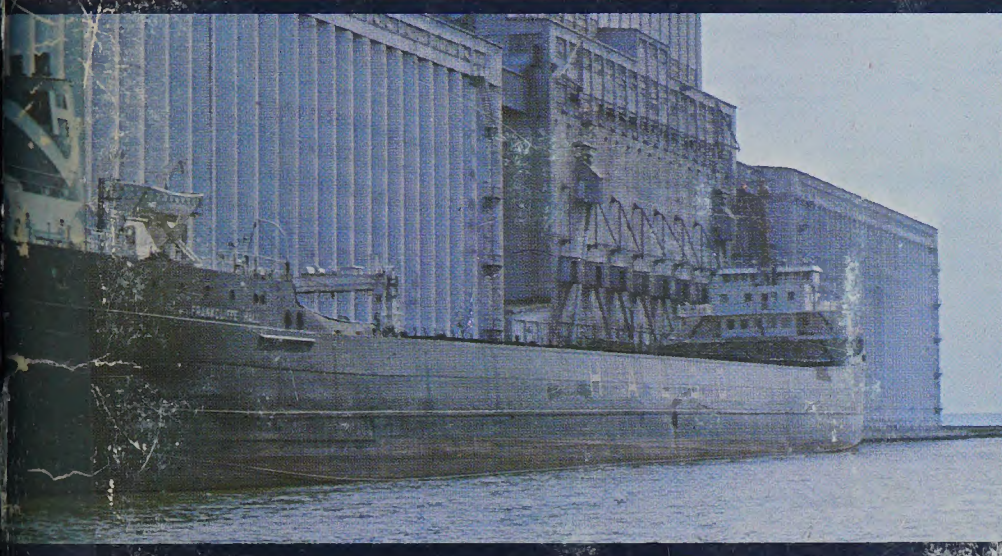


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General Editor: Evelyn Moore

People and Places in Canada

Author: Edward Koch



Home Oil, Calgary:

OIL EXPLORATION
AND PRODUCTION



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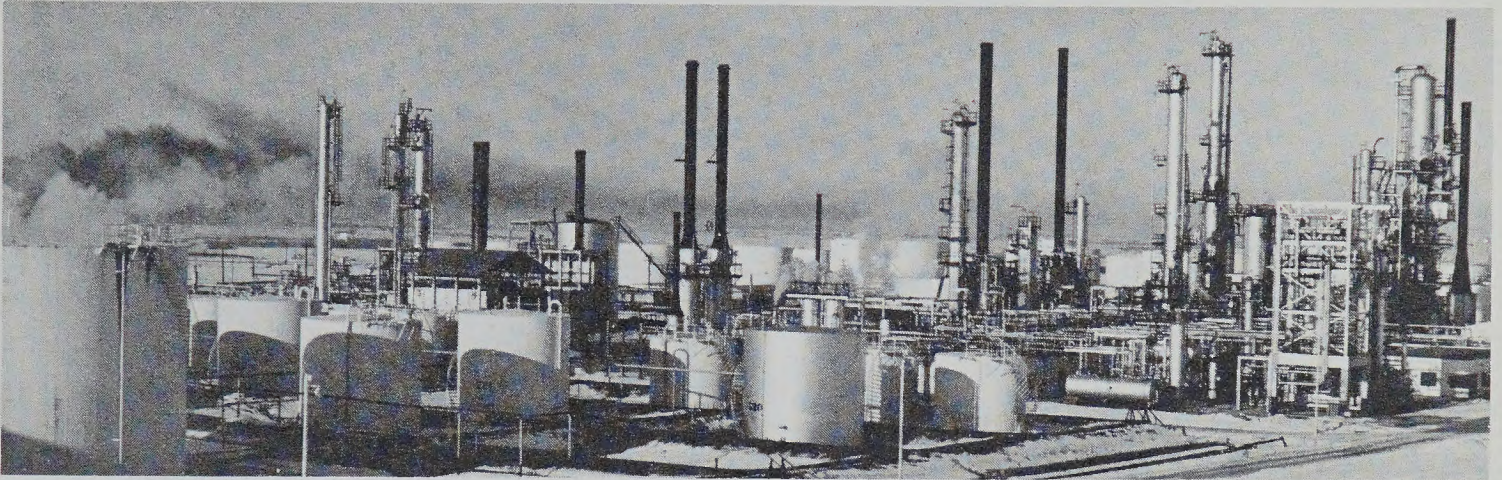
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Home Oil, Calgary:

Oil Exploration and Production



A sample study of an oil producing area

An inductive approach

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With the co-operation of teachers from British Columbia to Nova Scotia this sample study was tried out with some hundreds of grade 5 children. Substantial revisions were made using reports submitted by the pilot teachers. Further criticisms and suggestions would be welcome.

2855740



Introduction

In learning about the oil industry and some of the people who work in it we shall be doing more than just reading. In the pages that follow you will be shown many maps, graphs, charts and pictures and you will have to *read* them also. You will be asked to think and come up with *generalizations* from the different materials in this book?

What is a generalization? We might look at different kinds of wood to see if all or most woods float. If we try different samples of wood in water — spruce, maple, elm, and others — we find that all of these woods can float. We might be tempted to make a generalization that all woods float. We have not, however, tested every wood in the world — some woods such as ebony do not float. So if we do not have all of the facts our statement is an *hypothesis* — a statement that must be tested and proved. You will be asked many times in this book to make hypotheses and generalizations about the oil industry.

Some Suggested Activities

The *National Film Board* of Canada has a film called *Roughnecks*, about the Swan Hills oil field. If your school can get a copy of this film, it should be shown at least

twice. At the first showing pupils might try to make a list of as many different jobs as they can in the oil industry. For the second showing some questions might be divided among work groups:

Exercise

1.

Why might it be said that oil drilling is a young man's job?

2.

Would the jobs shown in the film be suitable or not suitable for men with families? Why do you think so?

3.

How would you describe the climate around Swan Hills from evidence in the film?

4.

Why was the pipe pulled every twelve hours or so?

5.

Would you describe work on an oil rig as dangerous? Why or why not?

6.

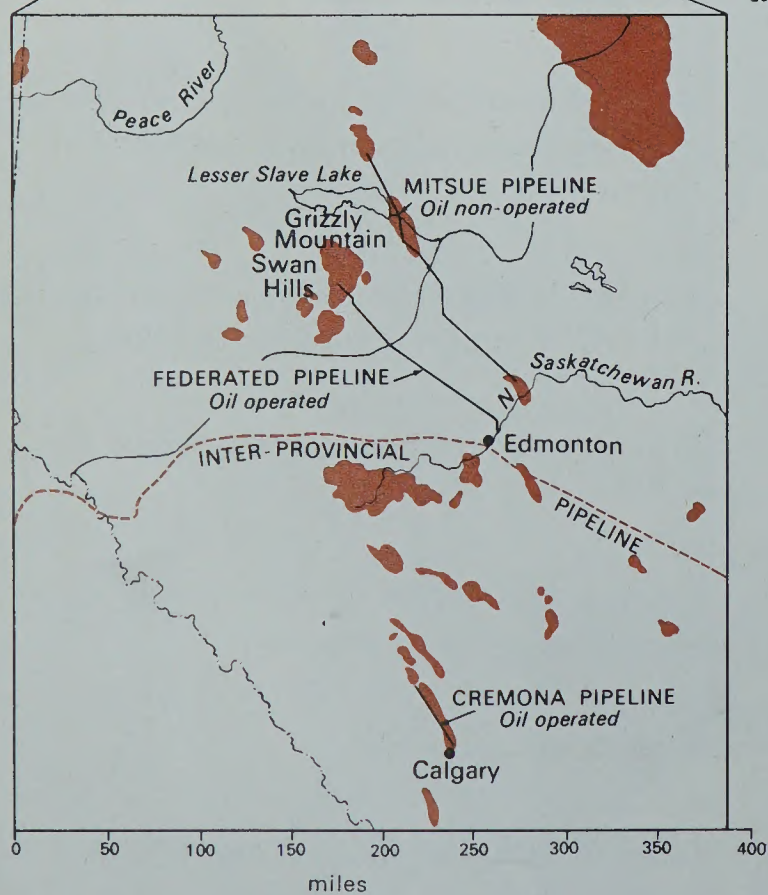
What is a scout's job?

7.

If rock bleeds what might it mean?



Figure 1



WHERE IS SWAN HILLS?

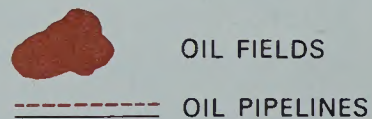


Figure 2

Roughnecks was made with the help of the oil company we are going to study.

Look at Figure 1 and 2 and answer the following questions.

Exercise

1.

Find Swan Hills on Figure 2.

2.

In what province of Canada is Swan Hills?

3.

What is the line that joins Swan Hills to Edmonton?

4.

Use the scale to work out how far the oil from Swan Hills flows to reach Edmonton.

5.

After the oil is refined in Edmonton how far does it have to go to reach Regina?

6.

Which is closer to Edmonton: Swan Hills or Calgary?

7.

Which is closer to Swan Hills, the Peace River or the North Saskatchewan?

8.

What is the lake north of Swan Hills? How long is it?

9.

Find Grizzly Mountain. Can you suggest a reason for its name?

I: Meet the Farrars of Swan Hills

The Farrar Family

Below is a photo of some newer residents of Swan Hills, the Farrar family. How old do you guess the boys are? Young Drew is not in the picture. You will meet him later.

Mr. Farrar is 41 years old. He has worked for the Home Oil Company since he was 22. How many years has he been in this job?

How many years was that before you were born? How many reasons can you think of for staying in this sort of job?

Mr. Farrar is a foreman. Look *foreman* up in your dictionary. Would a foreman get paid more or less than an ordinary worker? What might being a foreman have to do with Mr. Farrar's long time in this job?

Figure 3



A Trip to Swan Hills

Look at Figure 4. It is a picture of the town of Swan Hills as it looked in 1969. The Farrar family lives in the house marked by the arrow.

Exercise

1.

Can you find the school near the house? What other buildings can you identify? Try again later.

2.

How do you think the picture was taken? Is

there any evidence in the picture to support your belief?

3.

How many houses are there in the picture?

4.

What kind of houses do most of them seem to be — one family or apartment?

5.

Can you make any hypothesis (or good guess) about how many people might live in this town?

6.

What season does it appear to be? Find some very long shadows. Perhaps you could measure the changes in the length of a shadow throughout the year.

Figure 4



7.

What do you think had to be done before the town was built? Why do you think so?

8.

What do you think the people of Swan Hills might do for recreation? Is there any evidence in the picture as to what they might do? (Look at this question again after you have finished this unit.)

9.

Could you hypothesize the kinds of jobs people might work at in Swan Hills? What evidence can you give to support your hypothesis?

10.

If you guessed that about 1,700 people live in Swan Hills you would be about right. In a town of this size, which of the following businesses or services would you expect to find, and which would you not expect to find? Explain why.

- (a) bank
- (b) curling rink
- (c) school
- (d) laundromat
- (e) gas station
- (f) department store
- (g) grocery and meat store
- (h) hospital
- (i) art gallery
- (j) farm machine dealer
- (k) railroad station
- (l) veterinary surgeon
- (m) daily newspaper
- (n) musical instrument store

11.

Do you think you can find the main part of town or the downtown area of Swan Hills?

(Come back to this question after you have read the unit.)

12.

From the photo, how would you describe the country around Swan Hills? Are there any farms? Can you suggest why not?

13.

If you have been to see the film Roughnecks what else would you say about the Swan Hills area?

14.

If you have seen the film Roughnecks discuss how most workers lived in 1957 that was different from the way the workers in Swan Hills would live today?

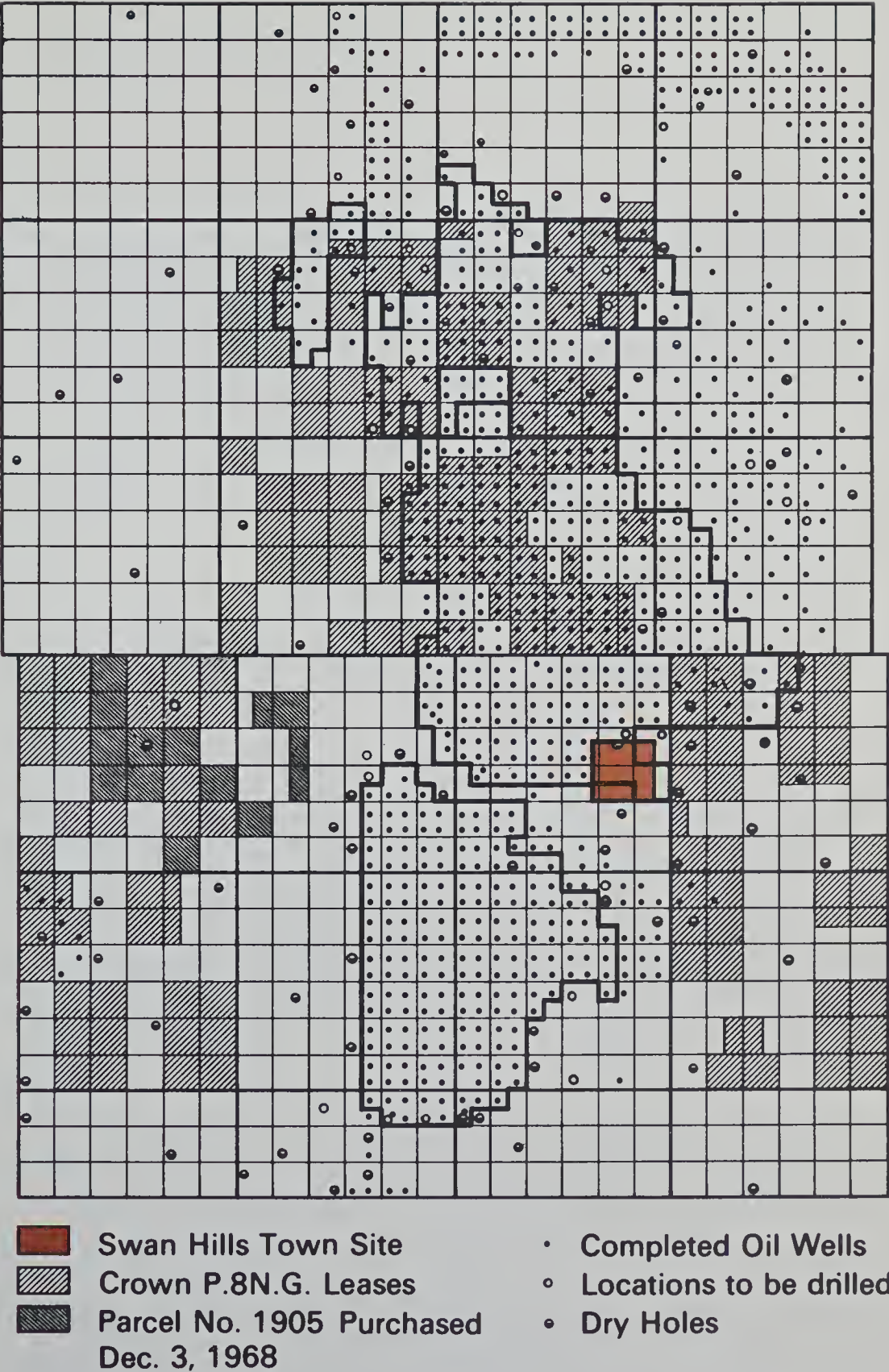
Figure 5 is a picture taken at the Home Oil Building in Calgary. The rods stand for or represent some of the oil wells in Swan Hills. Several colours are used on the rods. What do you think they stand for? Later on we will learn more about this.

Figure 6 is a map which in a different way stands for or represents the Swan Hills oil field.

Figure 5



Figure 6



Exercise

1.
What do the black dots stand for? Look at Figures 40 and 42.
2.
How can you tell that there is a great deal of oil at Swan Hills?
3.
Later on you will find out what crown leases are. Can you guess now? Find some on the map.
4.
Find the town of Swan Hills on Figure 8.

5.
What kinds of information are not shown on this map?
6.
When all the oil is collected from the wells that are working, where does it go? Look again at Figure 2.

Flight to Swan Hills

Often Home Oil employees in Calgary such as engineers, geologists, and others go to Swan Hills. There is no railroad to Swan Hills — although busses and cars can travel

Figure 7





Figure 8

by road. How far did you find it was from Calgary to Swan Hills? (Check Figure 2 again.) About how long would it take to drive this distance? How much longer do you think it might take under poor winter driving conditions? Are there many towns between Edmonton and Swan Hills? What might you hypothesize about service stations and motels along the way?

Swan Hills and other oil fields are often located far from settled areas such as cities and farm lands. Oil companies often have to build roads into new fields. Figure 7 shows a road in the Swan Hills area.

Exercise

1.

Look at the ruts on the road. What kind of road would you say this is?

2.

This type of road costs from \$8,000 to \$30,000 per mile. Why do you think road building would be so expensive in this kind of area?

3.

If you have seen the film Roughnecks can you think of any other difficulties in working in the Swan Hills area?

4.

Can you suggest reasons why Home Oil chooses to use airplanes to move some of its employees to Swan Hills?

Home Oil people from Calgary often want to get to Swan Hills quickly and safely and people at Swan Hills often want to go to Calgary or Edmonton. Hospitals and medical

services are located some distance from Swan Hills. Equipment and people are sometimes needed in a hurry. Figure 8 shows one of Home Oil's planes — a Beechcraft Queen Air — about to land in Swan Hills.

How many engines does the Beechcraft have? The landing strip is 4,400 feet long and cost over \$50,000. How does this airfield look in comparison with others you might have seen? Why do you think the pilot would want to take off on his return trip before sundown?

As the plane flies north from Edmonton it passes over evidence of oil activity. Examine Figures 9 and 10 carefully — one is a battery and the other is storage tanks— we shall look at them again when we study oil production. What do you think had to be done before the buildings and equipment were constructed? Do you think building in this area would be expensive? Why? What hypothesis would you venture about the size and wealth of oil companies?

Figure 9





Figure 10

A Day in Swan Hills with the Farrars

By the end of 1968 the Farrars had lived in Swan Hills for seven years. What year would the Farrars have moved into Swan Hills? How old would the town of Swan Hills have been at that date? (The first well was completed in 1957.) How old were you when the Farrars moved to Swan Hills?

What modern conveniences can you identify from the photo of the Farrar's house (Figure 11)? Many of the houses in Swan Hills are built by the oil companies and rented to the workers. Why do you think the companies might do this instead of having their workers, buy, build, and (if they move) sell their own houses?

Figure 11



There are about 120 family houses in Swan Hills. There are also apartment houses provided for school teachers working in the town. A third type of residence is shown in Figure 12. Can you read the sign in the right side of the picture? Can you hypothesize why people might live in these units rather than houses?

Swan Hills has a hotel (18 rooms) and a motel (24 units). Have you ever stayed at a hotel or motel? What kind of guests do you think would stay at Swan Hills' motel or hotel?

When the Farrars first moved into Swan Hills everyone lived in trailers. If you have viewed the film *Roughnecks* you can get some idea of how muddy it must have been.

Figure 12





Figure 13

There were no sidewalks and everyone used propane for fuel. People were very neighbourly and helpful. In what ways was this like the life of the pioneers?

Exercise

1.

Note how Mr. Farrar dresses for work. How does this differ from the people you know? Why do you suppose he wears the kind of hat he does?

2.

What does Drew's clothing tell you about the weather?

3.

What modern conveniences can you find in Mrs. Farrar's kitchen?



Figure 14



Figure 15

Figure 16 is a picture of the Swan Hills school. The school has 275 students, 14 teachers, and grades 1 through 10. Can you think of any problems for families like the Farrars whose eldest boy Robin is in grade 10? What are some things they or their son can do in order that Robin could go on to grade 12? What could not be done with only a grade 10 education? The school is very modern and has most of the things such as film projectors and other teaching equip-

ment that you would find in a city school. The student union runs the only movie theatre and prints the only newspaper in town.

Mr. Farrar usually starts his day at the Home Oil office building in Swan Hills shown in Figure 17. Find the Home Oil office on the picture of Swan Hills (Figure 4).

Mr. Farrar usually arrives at his office at 8:00 A.M. He does his paper work — daily reports of various kinds. He is responsible

Figure 16



Figure 17



Figure 18



for 276 oil wells. He receives radio calls from the field. His men all have mobile radios, and there is one in his car. Many different kinds of problems arise — equipment and machinery freeze-up; sometimes there are dying wells; what has happened to the fir trees in Figure 18? What problem would this photo suggest?

Figure 19 suggests another *kind* of problem which Mr. Farrar might have to deal with. (The kind of vehicle shown below is not used in Mr. Farrar's work, but in new oil fields.)

Figure 19



Exercise

1.
How would you describe what you see in Figure 19?
2.
What time of year do you think it might be? Why?
3.
Do you know what northern Canadian swamps are called? Have you ever heard the word muskeg? Perhaps you could look it up in your encyclopedia.
4.
How might Mr. Farrar and his men get a vehicle out? Do you think it possible that the vehicle might sink out of sight? How could you find out?

Below and on the next two pages are some sights Mr. Farrar would see in his daily rounds. One of the photos shows an old campsite from the early days. How do you know it belongs to the early days?

Also shown is a close-up of a flare — which one might it be? Why do you think oil companies tell forest rangers about lighting

Figure 20



Figure 21



Figure 22



Figure 23



up flares? Figures 22 and 23 show storage tanks, batteries, and wells which we will be looking at in unit V.

An Interview with the Farrars

We asked the Farrars what they liked about Swan Hills and what they did not like. Mr. Farrar liked the outdoor activities — hunting and fishing. He especially enjoys hunting big game — moose — but also geese and other game. Both Mr. and Mrs. Farrar are active in local organizations such as the Oil Wives Club, the Home and School, the Lions Club. Mr. Farrar is also a town alderman and school board member.

There are certain things which Swan Hills lacks. Mr. Farrar likes to golf but the nearest course is 65 miles away. There is no

doctor or hospital in the community — the nearest being again 65 miles away. People having children who have completed grade 10 either have to leave, board their children away from home, or have them leave school. There are few repairmen if things go wrong. Can you make a list of some of the different kinds of repairmen and service workers your family needs to use from time to time?

Robin pointed out that teen-agers are not always happy in Swan Hills. There are not many of them and often they feel there is little to do.

Mr Farrar also pointed out that he thought the prices of things in stores tended to be higher than in the city. Can you think of some reasons why this might be so?

If a man in the city had about the same income as Mr. Farrar would he be able to afford a bigger house than Mr. Farrar? Why? Check this out in our next story.

II: Meet the Verner Family of Calgary

Figure 24 is a photo of the Verner children — Brent (aged 10), Jacqueline (aged 7), and Roberta (aged 3). Do you think you can identify them properly? What grades in

school would you guess the children to be in.

Figure 25 is a picture of the Verner house in the city of Calgary.

Figure 24



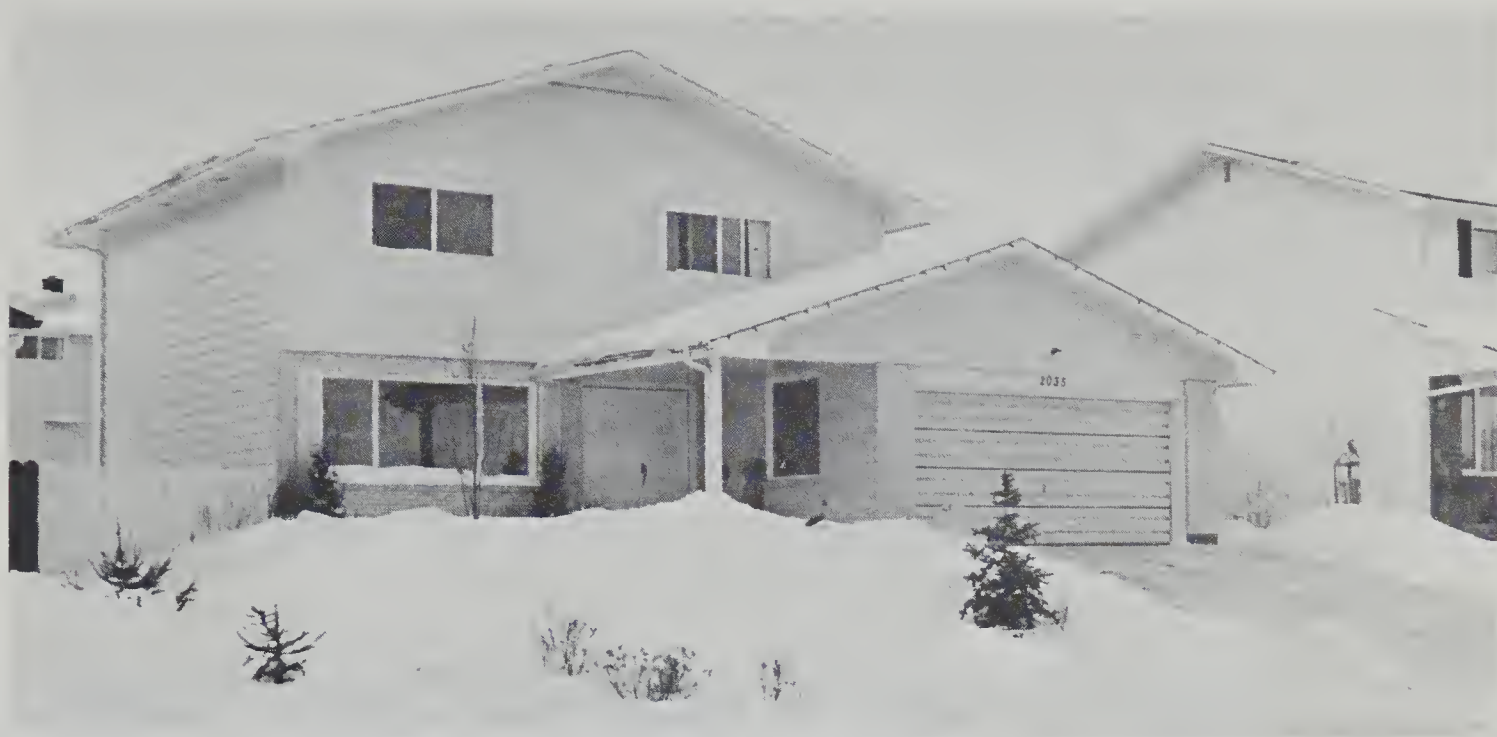


Figure 25

Exercise

1.

What time of year is it?

2.

Would you guess the garage to be for one or two cars?

3.

Would you consider this a large or small house? Why do you think so?

Mr. Richard Verner is a mechanical engineer. He is in charge of the Pipeline Department at Home Oil and we shall find out more about this later on.

The Verners get up at about 7:00 in the morning — Roberta is usually the first one up. Mrs. Verner prepares breakfast which is served about 8:00 A.M. Mr. Verner leaves for work and the children for school. If it is especially cold Mr. Verner drives Brent and

Jacqueline to school — though they usually walk.

Read the temperature scale overleaf to find out in which months the car would be used to take Brent and Jacqueline to school? How does Swan Hills compare in temperature with Calgary? What effects might these temperatures have on the lives of the Verners and the Farrars? How do these temperatures compare with the coldest days in your community last winter? Some Swan Hills figures were not available when we looked for them. Can you guess about what they might be?

Figure 26 shows the Verner family starting a typical day. Mr. Verner has his work clothes on. How do these differ from those worn by Mr. Farrar? Could you hypothesize about the kind of work a person might do from the way he dresses?

Before going to school Brent and Jacqueline play with some of their toys. Each of the

Temperature Scale — Calgary and Swan Hills

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Calgary	0.1	10.8	7.9	21.7	34.8	42.3	46.9	47.5	42.2	29.8	18.5	5.5
Swan Hills	3.5	5.1	0.6	N/A	35.4	42.2	48.3	51.0	45.6	29.7	N/A	3.7

Average Minimum Temperature (deg. F)

1967

Monthly Record Meteorological
observation in Canada

(Dept. of Transport Meteorological
Branch)

Figure 26



children has his or her own room. The children like to ski, skate, and ride snowmobiles in the winter. Brent also likes to play hockey. In the summer the family enjoys visiting at an aunt's farm in Saskatchewan. Mr. and Mrs. Verner like to ski and curl.

Mr. Verner warms up the car shortly before leaving.

What does Figure 27 tell us about the climate and time of year?

Figure 27



Figure 28





Figure 29

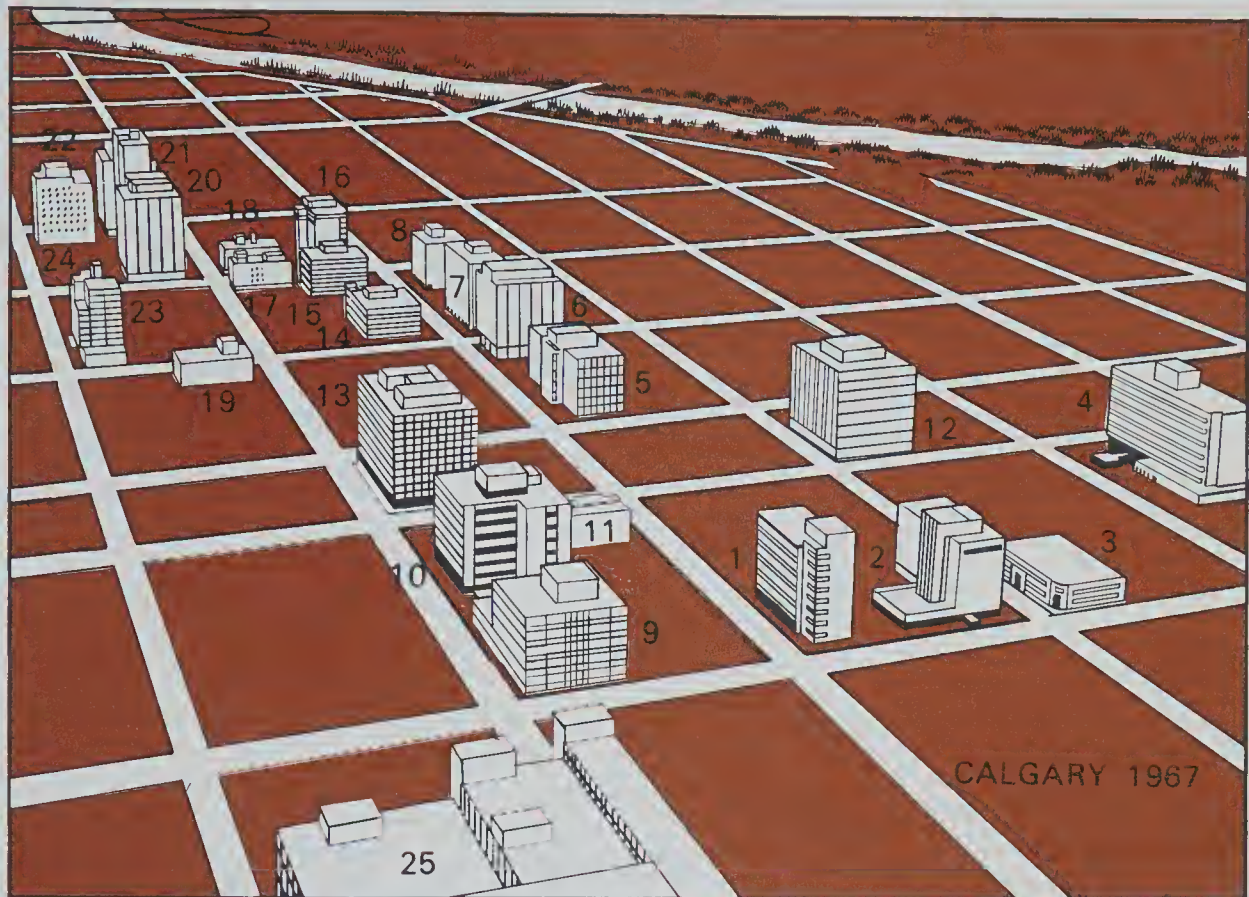
Figure 29 shows the school which Brent and Jacqueline attend. Brent is in grade 4 and Jacqueline in grade 2. Their school is

called the University Elementary School.

How would you describe the building?
Would you describe this as a new or old

Figure 30





- | | |
|--|---|
| 1. Home Oil Company Limited | 15. French Petroleum Co. of Canada Ltd. |
| 2. Alberta Wheat Pool | 16. Canadian Superior Oil Ltd. |
| 3. Ranger Oil Co. Ltd. | Amerada Petroleum Corporation |
| 4. The Calgary Inn | 17. North Canadian Oils Ltd. |
| 5. Imperial Oil Limited | 18. Dome Petroleum Ltd. |
| 6. Jefferson Lake Petrochemicals of Canada Ltd. | 19. Triad Oil Co. Ltd. |
| Banff Oil Limited | 20. British American Oil Co. Ltd. |
| 7. Texaco Canada Limited | 21. Texas Gulf Sulphur Company |
| Independent Petroleum Association of Canada | 22. Kern County Land Company |
| 8. Western Decalta Petroleum Ltd. | 23. Socony Mobil Oil of Canada Ltd. |
| Fargo Petroleums Ltd. | 24. Canadian Fina Oil Limited |
| 9. Royalite Oil Co. Ltd. | Canadian Export Gas & Oil Ltd. |
| 10. Hudson's Bay Oil & Gas Company Ltd. | Central-Del Rio Oils Limited |
| 11. Chevron Standard Limited (future site is 12) | Great Plains Development Company of Canada Ltd. |
| 12. Pan American Petroleum Corporation | Tenneco Oil & Minerals Ltd. |
| 14. Oil & Gas Conservation Board | 25. Hudson's Bay Co. |

Figure 31

school? Why do you think so? Why might a city need many new schools? You can check this in the next section about Calgary. How does this school compare with the Swan Hills school on page 15?

Calgary, a City that Grew on Oil

Look at Figure 30. It is a picture of downtown Calgary taken from the air, in fact from the

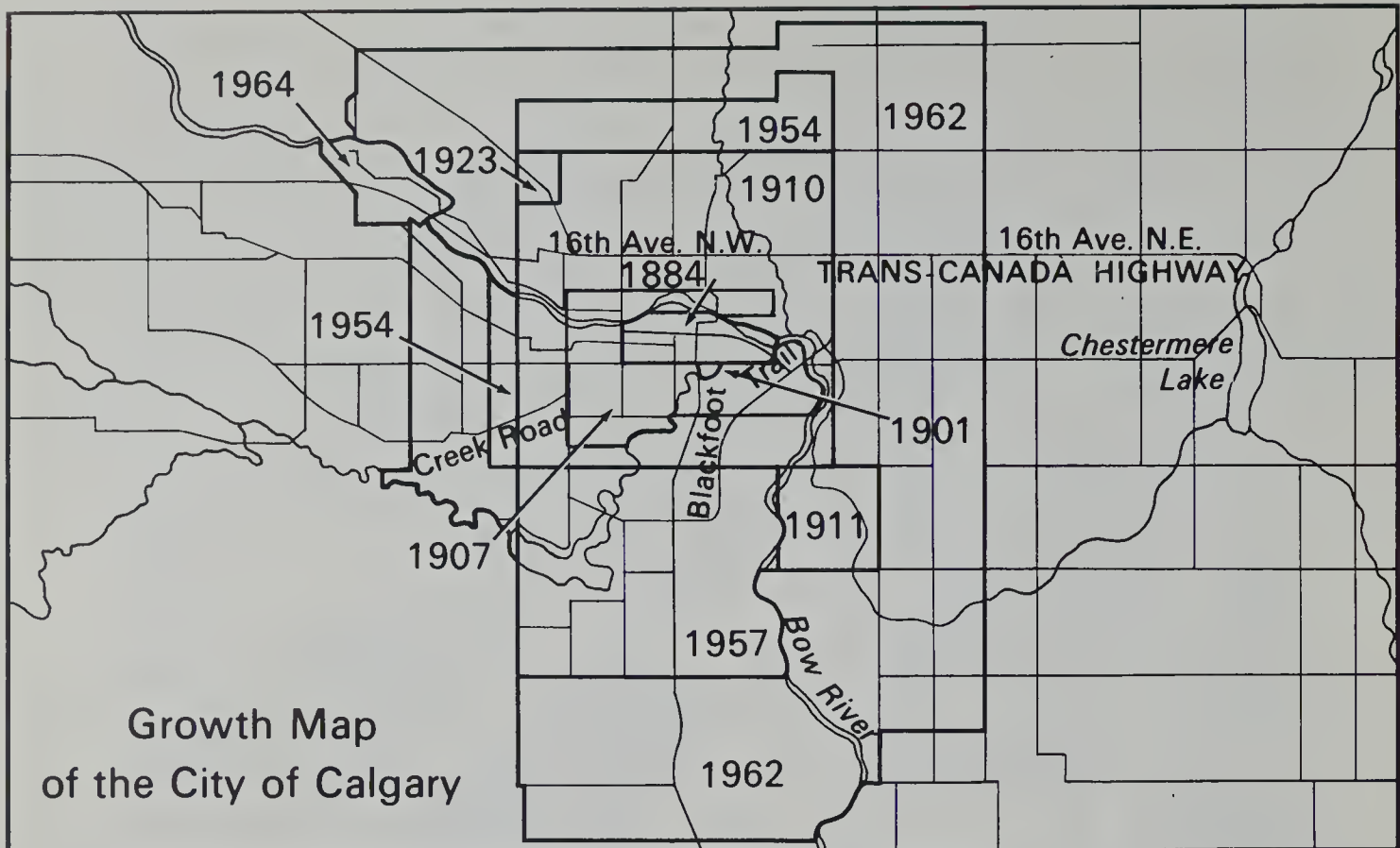


Figure 32

Husky Tower. Can you find some new tourist pamphlets with pictures of this tower?

Exercise

1. What clues tell that Calgary is a fairly large city?

2. How many stories high are some of the taller buildings?

3. Why do you think buildings in a downtown area tend to be tall?

4. Note the date of this diagram. Perhaps you could get a more recent one from the Cal-

gary Herald or the Albertan newspaper and see if there have been any changes.

Calgary is one of Canada's fastest growing cities. Below are some figures showing the growth of some major cities in the prairie provinces:

	Calgary	Edmonton	Greater Winnipeg
1901	4,400	4,200	42,000
1911	44,000	31,000	136,000
1921	63,000	59,000	179,000
1941	89,000	94,000	222,000
1951	129,000	160,000	236,000
1961	250,000	*337,000	*474,000
1966	330,000	*400,000	*509,000

*Metropolitan areas — taking in communities around the city.

Exercise

1. Which city grew the most in the first ten years?
2. Which grew the most in the last five years?
3. Swan Hills is only one of many new oil areas producing in recent years. Can you suggest why Calgary and Edmonton grew so fast?

Study Figure 31.

Exercise

1. How old is it?
2. How many buildings are connected with the oil industry?
3. Which buildings provide services for people?
4. What clues can you find about other industries in Calgary?

We are especially interested in one building — the Home Oil Company — where Mr. Verner works.

5. Can you find this building on both the diagram and the picture, Figure 30?

Exercise

1. Study the map, Figure 32, which shows the

different times that Calgary added extra land to the city. When were the largest additions after 1910 made?

2. Can you suggest reasons for this?

A Day at Home Oil

After dropping off his children Mr. Verner drives to downtown Calgary — 6th Avenue — to the Home Oil Building pictured below.

Exercise

1. How does the Home Oil Building in Calgary

Figure 33





Figure 34

compare with the Home Oil Building in Swan Hills on page 15? How do the two buildings differ?

2.

What hypothesis could you make about the numbers of people working in them and the importance of each building? What evidence might support your hypothesis?

Figures 34 and 35 show Mr. Verner at work. Can you describe what Mr. Verner seems to be doing in each photo? From the way Mr. Verner is dressed and the kinds of things he is doing, what hypothesis might you make about the kind of work people in the Home Oil Building tend to do? We shall find out more about this department in unit V.

Figure 35



III: Drilling and Production

Mr. Farrar, who began our story, is a Field Production Foreman. By this we mean that he supervises the field men working in the production of oil and gas. He also supervises the repair and maintenance of equipment used for production.

If you remember the material in the last unit and saw the film *Roughnecks*, you know that before 1957 people did not know whether or not there was any oil in Swan Hills. Think back (and look if you wish) at units IV and V. How do oil companies obtain the information which would encourage them to explore for oil in an area such as Swan Hills?

A well being drilled in an area where no previous production has been found is called an exploratory well. Why do you think this is so? If enough oil and/or natural gas is found, the well is called a *discovery*. What would you guess a *dry hole* to be?

Drilling for Oil

Oil and/or gas is found at varying depths. There are producing oil wells in California less than 100 feet deep, producing wells in other areas may be more than 18,000 feet deep. A dry hole in Texas was drilled to 25,000 feet. About how many miles deep

would the Texas dry hole have been? What effect would this have on the cost of oil?

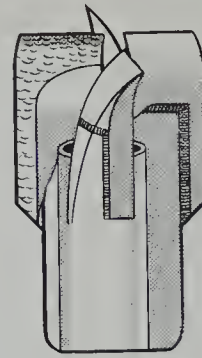
Let's take a closer look at the equipment used in drilling and production. A drill is the machine used to make the hole in the ground using a rotary motion, similar to the action of a carpenter's drill. A bit is the cutting part of the drill. On page 30 are some types of bits used by oil men.

Exercise

1. *What kind of drill appears in Figure 36?*
2. *What would you hypothesize about the kind of ground being drilled?*
3. *How would you describe the job being done in the photo?*
4. *What type of clothing and equipment do the workers require?*

Drilling rigs operate twenty-four hours a day. One drilling supervisor called a *tool-push* is in overall charge of the rig. A rig crew has five men in it. Each crew works an eight-hour shift. How many men would be needed over a twenty-four-hour period?

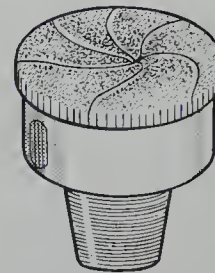
Figure 36



FISHTAIL BIT
FOR SOFT ROCKS



HARD FORMATION BIT
FOR HARD ROCKS



DIAMOND CORE BIT
FOR CORING

THREE TYPES OF BITS
USED BY OILMEN

The drilling string consists of the drilling bit, drill collars and drill pipe. Find them in Figure 39. Look at the sharp teeth on the bottom of the drilling bit in Figure 36. What would you guess the job of the drilling bit to be? Alongside the photo are some types of bits used by oil men. The drill collars are hollow steel tubes weighing from one to three tons each. From two to thirty of these drill collars are connected above the bit, the number depending in most cases on the amount of weight required on the bit to make it drill effectively. Why do you think the bit needs the weight of the collars?

The drill pipe is a tube generally twenty to forty feet in length. How long is your classroom? As the hole is deepened more sections or joints of drill pipe are added to the drill string. Whenever the bit becomes worn all the drilling string must be pulled out of the hole and the bit changed. Why do you think this is so?

Exercise

1.
How many lengths of pipe can you count in Figure 37?

2.
Do you think there are more lengths than can be counted? Perhaps if you arranged some pencils as the pipe is in the photo, you might get an idea of the number of lengths.

3.
Find the chain that is used to connect and disconnect the pipe?

4.
Do you think this could be dangerous? Why?

5.

Would you expect these men to get more pay than many town workers? Why?

Drilling Fluid

Drilling fluid (usually called mud) continuously flows down the inside of the drill string, through the bit and up the outside of the drill string. This is accomplished by the use of large pumps called mud pumps.

The mud circulation system has many purposes. It lubricates the bit, and removes the cuttings from the well bore. It deposits a thin cake on the walls of the hole to prevent caving and reduces the escape of water or oil. The mud keeps the well under control when high pressure gas or water zones are entered, and it reduces friction of the drill string. How many uses for the mud can you now remember?

Figure 38 is a photo of a modern drilling rig. Alongside is a diagram showing the different parts. Can you find some of these parts named on the diagram on the photo?

Look again at Figure 39. Find a part of the rig called the *draw works*. It is a winch which reels in and feeds off the cable when raising and lowering the drill string. Why is the draw works needed?

Can you find the *kelly*? The kelly is a square hollow pipe connection to the last joint of drill pipe and passes on the turning motion of the rotary table through the drilling string to the bit.

Have you seen any movies about the oil industry? Very often when oil is struck, the movie shows the oil shooting up into the derrick and everyone dancing around and

Figure 37

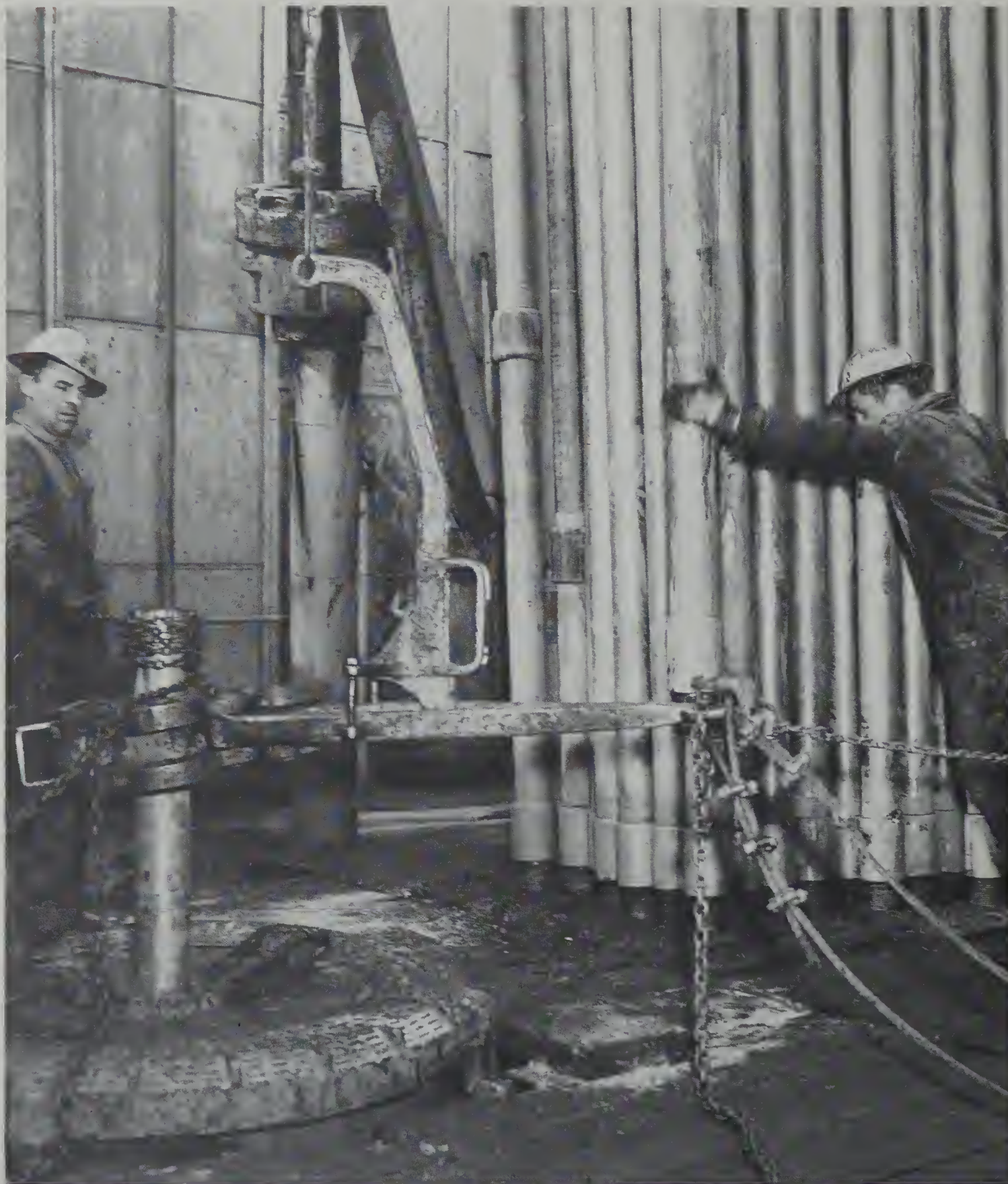
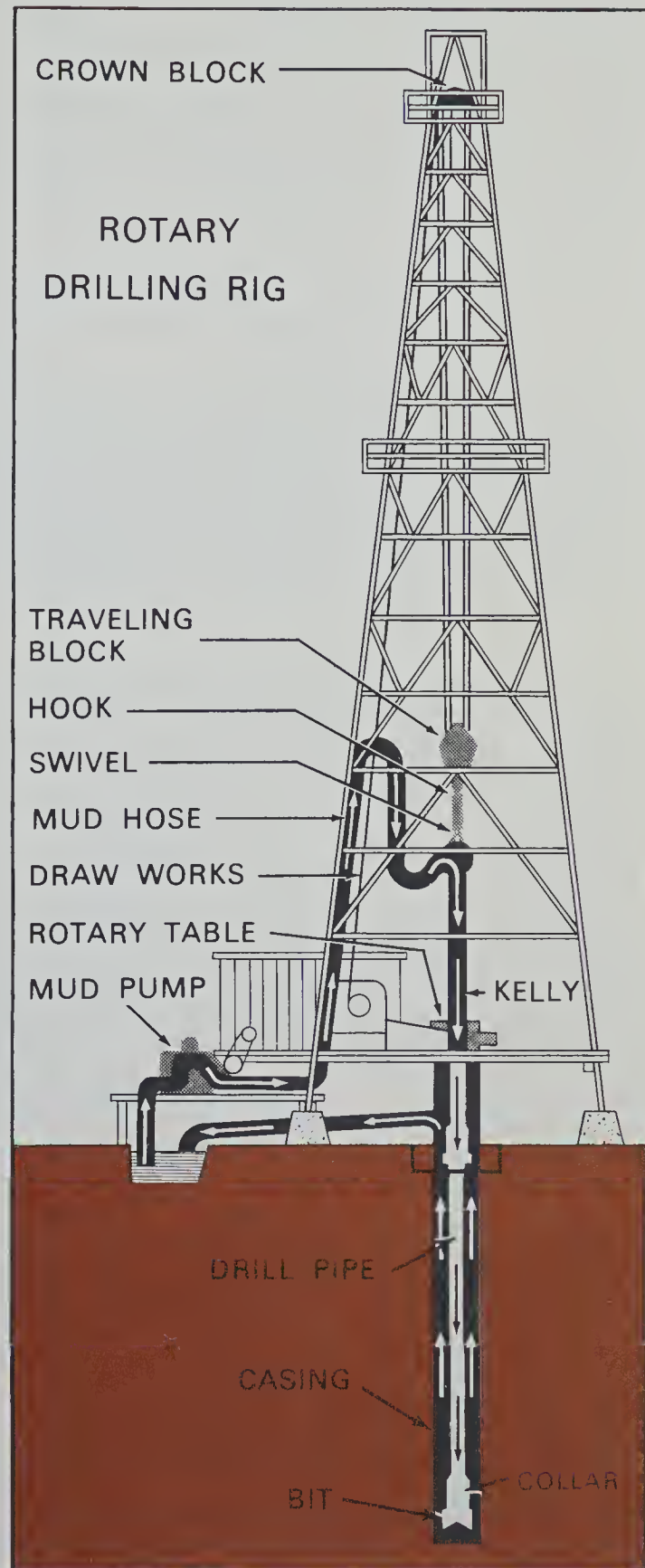


Figure 38



Figure 39



embracing each other while the gusher gushes. It may have been that way in the past, but modern discoveries are kept under control at all times, and no oil is allowed to escape. Why do you think the oil is not allowed to run or flow as it does in the movies?

If our drilling crew were to make a discovery a string of casing would be run in the hole and cemented in place.

Can you think of some reasons for doing this? What might otherwise happen to the walls of the bored hole? Is there a possibility of water entering into the well — what about cave-ins?

Figure 40 is a picture of a wellhead. We shall find out more about it in the next section. It is called a Christmas tree and works a little like a bathroom tap to control the oil that flows from the well.

Production

An oil well can be described as a pipe reaching from the top of the ground to the oil below the ground. It is through this pipe that oil is brought to the surface. The pipe is several sections of casing screwed together to form a tube for the oil to flow through.

Producing wells are of two types — flowing or pumping. In a flowing well, water or gas pressure forces the oil to the surface. For the flowing well the wellhead as shown in Figure 40 would be used. The oil and gas must be separated. Look at Figure 41.

Exercise

1.

Where does the oil and gas go from the wellhead?

2.

What does the separator do?

3.

Why is the oil at the bottom and the gas at the top?

4.

Where does the gas go from the separator?

5.

Where does the oil go from the separator?

6.

Where does oil go from the storage tank?

Look at Figures 22 and 23 again. Can you now identify what some of the uses of different parts of the plant are? Can you find any separators? Any storage tanks?

Figure 40



Figure 41

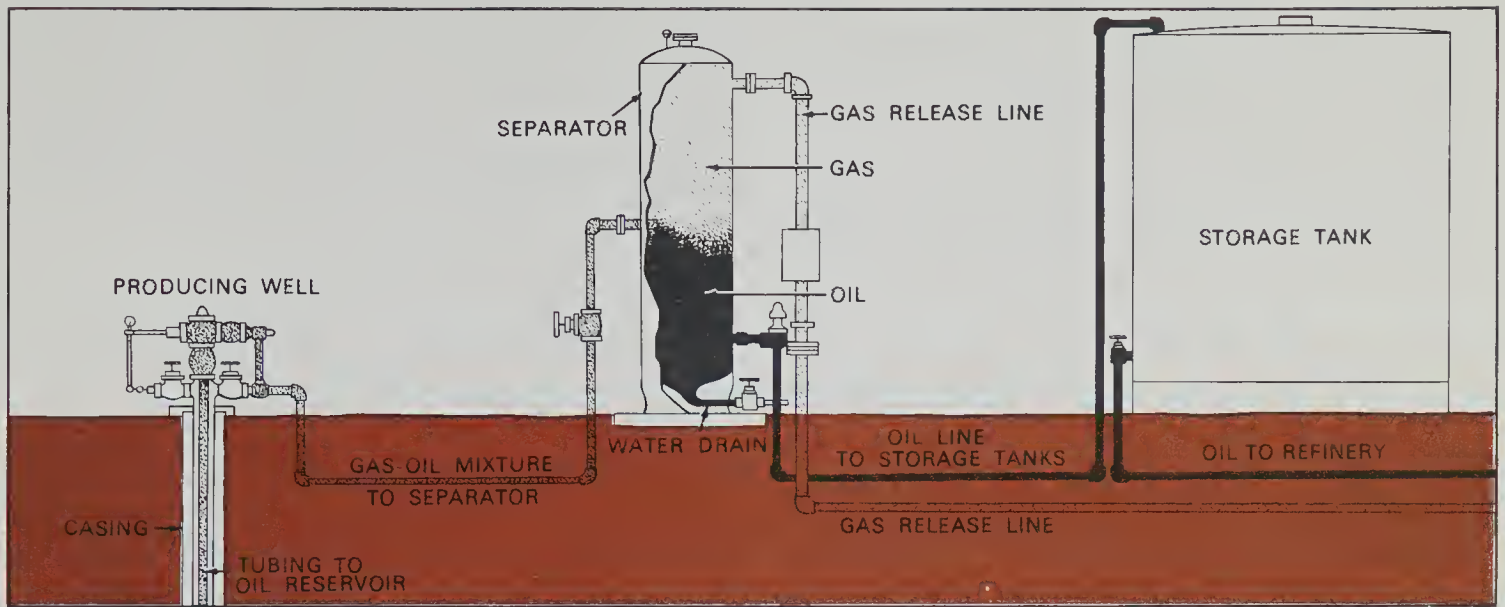


Figure 42



For wells which do not flow freely a pump may be used to bring the oil to the surface. A common sight on the Western California prairies is the pump in Figure 42 driven by an electric motor.

The part of the pump attached to the pump rod string is called the bridle, which is in

turn attached to the horse's head. Do you think these are good names? Why or why not?

Look back to what we said about Mr. Farrar on pages 14 to 18. Can you suggest some jobs that the men he supervises would work on?

IV: Home Oil Moves Its Oil

We read about Mr. Verner in unit II. Mr. Verner's job deals with the transportation of oil. We will learn in this unit about the different ways oil is moved from one place to another in Canada.

Oil is a *bulk* commodity. By this we mean that it is sold in large amounts — in tons, barrels or gallons. When people buy coal or oil or iron ore they usually buy in large amounts or in bulk. If you were a businessman in the oil or coal business today and wanted to send your oil or coal as cheaply as possible about a thousand miles away, what are some ways you could move your materials? Would you have some men carry it on their backs? Would you hire some wagons pulled by mules? Could you put the bulk commodity aboard airplanes? Why would you not use these means?

Look up a population map of Canada in your atlas. In what parts of Canada do most people live and need oil? In what parts of Canada is most oil produced? What problem do we have here?

In Canada today most oil is moved through pipelines. Sending oil by large tankers is also very cheap and efficient but it is used in Canada chiefly on the Great Lakes. A small amount of oil is moved by trucks or railway tank cars. Study Figure 43 and answer the following questions.

Exercise

1. *What western Canadian city do many of the main pipelines go to and come from?*
2. *Can you make any hypotheses from the legend on the map as to why so many pipelines tend to be located in one Alberta city?*
3. *What is the longest pipeline in Canada?*
4. *Which pipelines are both in the United States and Canada?*
5. *Which pipeline on the map goes farthest north?*
6. *Some cities on the Atlantic coast such as St. John's, Halifax and Saint John are shown as major oil refining centres. There are no pipelines going to these cities. Where would you hypothesize that these three cities get oil for their refineries?*
7. *How many pipelines go into the Montreal area?*
8. *How many pipelines go into or come from Toronto?*



Figure 43

Which pipeline carries Alberta oil across the Rocky Mountains to Vancouver and the northwestern United States?

In 1939 there were less than 200 miles of pipeline in Canada. Today there are about 13,000 miles of pipeline. About how many times the 1939 total is the 1969 total?

Building a Pipeline

Before building a pipeline engineers need information about the shape of the land — its hills, lakes, rivers, and swamps. Air-

planes fly over the likely route and take photographs. From these photographs engineers can lay out a path for the pipeline.

This is not enough information for the engineers. A ground survey crew is sent out along the route to bring back more information.

Oil is found in many different kinds of places — mountains, deserts, prairies, forests, etc. In the film *Roughnecks* in what kind of country was oil found? Many times oil is found in areas that are wild and far from cities and towns. Rough roads need to be built to the fields where men are drilling for oil. Trucks and machinery need to come in and go out.

Figure 44 is a photo of one of these machines. It is called a trenching machine.

Exercise

1.

What does this machine do?

2.

Why do you think it does this?

No matter what the land is like the pipeline must go through, whether the route be through muskeg, rock, rivers or lakes. Long pieces of pipe are brought to the area — usually by truck. Pipes have to be very carefully put together. Why do you think this is so?

Figure 44



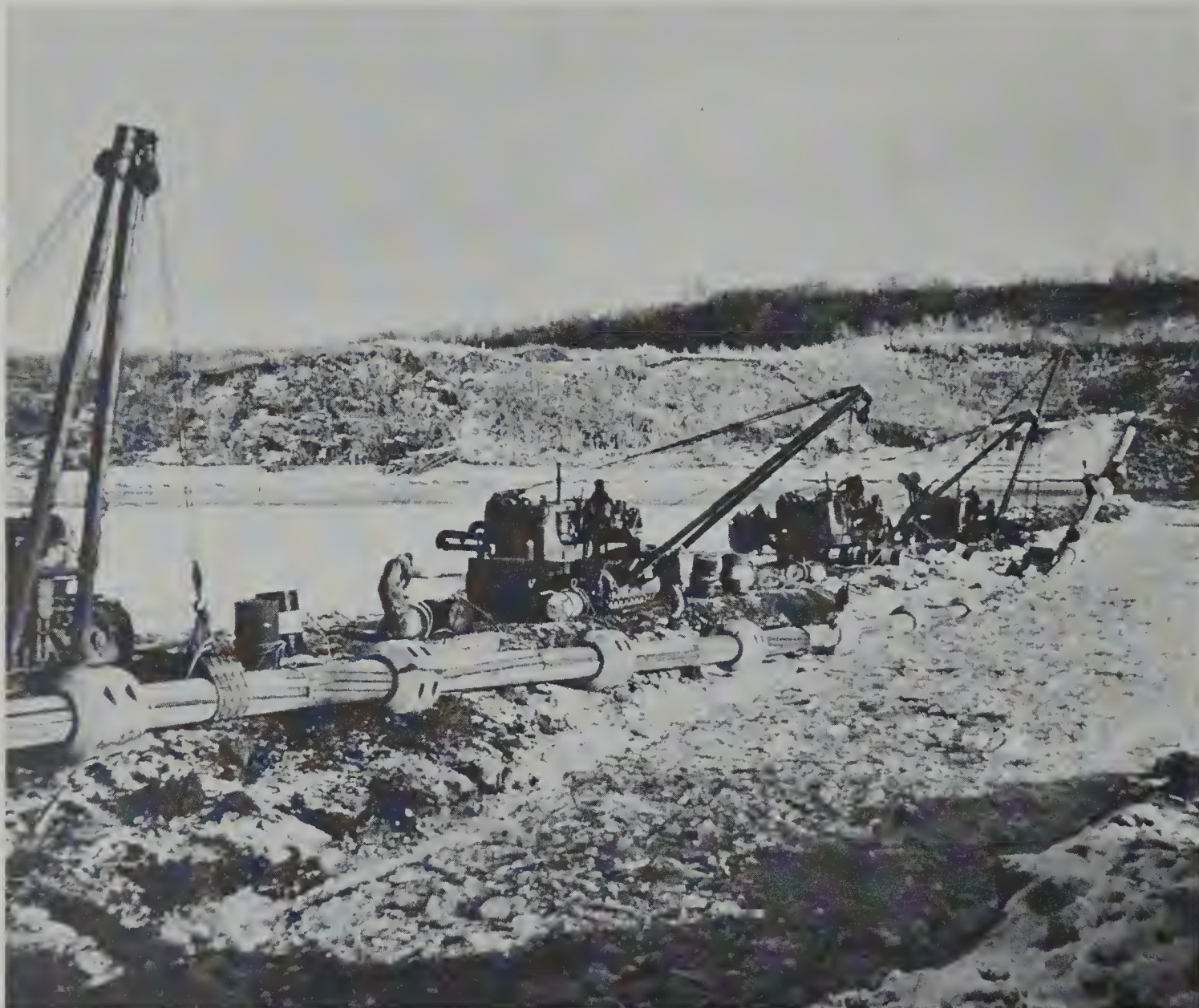


Figure 45

Figure 45 is a picture of side-boom tractors.

Exercise

1.

What does the side-boom tractor seem to do?

2.

Do you see any natural obstacles which the crew must face?

After the boom tractor lays the pipe in the ditch bulldozers push the dirt back in. At intervals of 20 to 80 miles along the pipeline there are pumping stations. Why do you think these stations are needed?

The cost of some Canadian pipelines is shown below:

<i>Name</i>	<i>Length of Line (miles)</i>	<i>Cost</i>
Key Pipe Line Co., Ltd.	6	\$ 160,000
Royalite Oil Co., Ltd., Mid-Saskatchewan Pipelines Dept.	81	\$ 1,000,000
South Saskatchewan Pipelines Co.	365	\$16,500,000
Green River Exploration Co., Ltd.	15	\$ 400,000
Sun Canadian Pipe Line Co., Ltd.	211	\$ 6,100,000

Can you figure out about how much the cost for one mile would be for each of the above pipelines? What generalization could you make about the cost of building pipelines?

It costs a few cents — about the cost of a postcard to send a gallon of oil from Leduc, Alberta to Toronto. Can you check your atlas to find out how far it is from Leduc to Toronto? From the above facts we know it costs very little to keep the oil flowing — some pumping stations do not even require workers.

Can you form a generalization about the cost of building a pipeline and the cost of running a pipeline once it is built?

From information in this chapter can you develop a generalization about how oil tends to be transported in Canada?

The crude oil goes by pipeline to compli-

cated plants called refineries. There are large refineries in Edmonton, Vancouver, Sarnia, Montreal and other Canadian cities. The crude oil which comes out of the ground cannot be used in cars or trucks. The job of the refinery is to turn the crude oil into gasoline, diesel fuel, kerosene, chemicals and other products. From the refineries the gasoline goes to service stations and other products go to other businesses.

There are thousands of service stations throughout Canada. Could your class visit one of them and have the owner talk about his work and his problems? Prepare a map of all the service stations in your area. In what positions do you find service stations? Often you will find two or three together. Does your map show this? Do the customers need several together? Why do you think they are there?

Figure 46



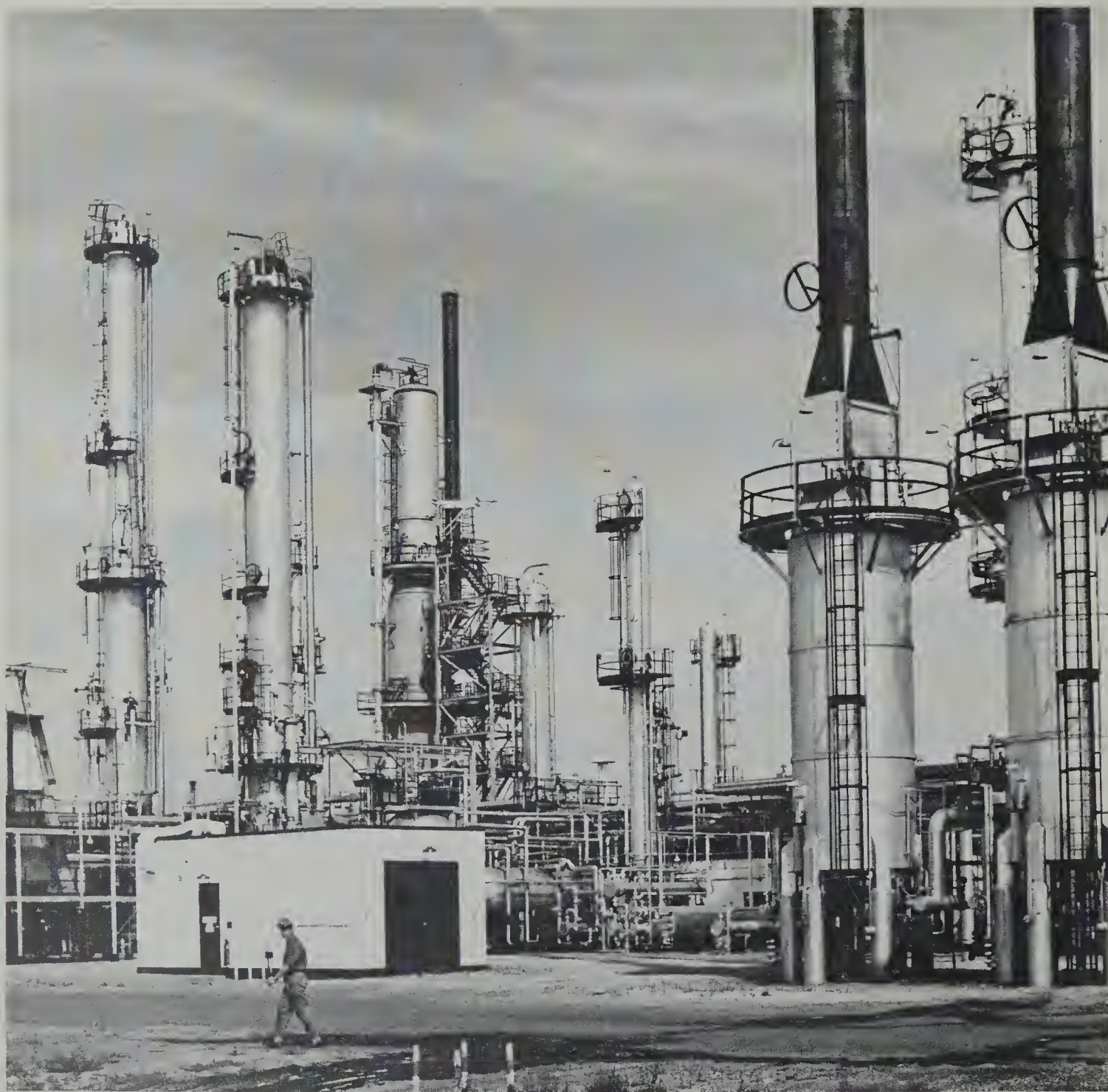


Figure 47

Figure 47 is a photo of a refinery. Are there any oil refineries near where your school is? Is it possible to take a field trip to the refinery? Would the refinery send someone to talk to the

class on what the refinery does? Perhaps you can write to an oil company for a flow-chart showing what happens to the crude oil as it goes through the refinery.

V: The Significance of Oil for Canada

Have you ever thought of what might happen if all of the world's oil were to suddenly disappear? Think about this for a few moments. What are some changes you and your family would need to make if this happened?

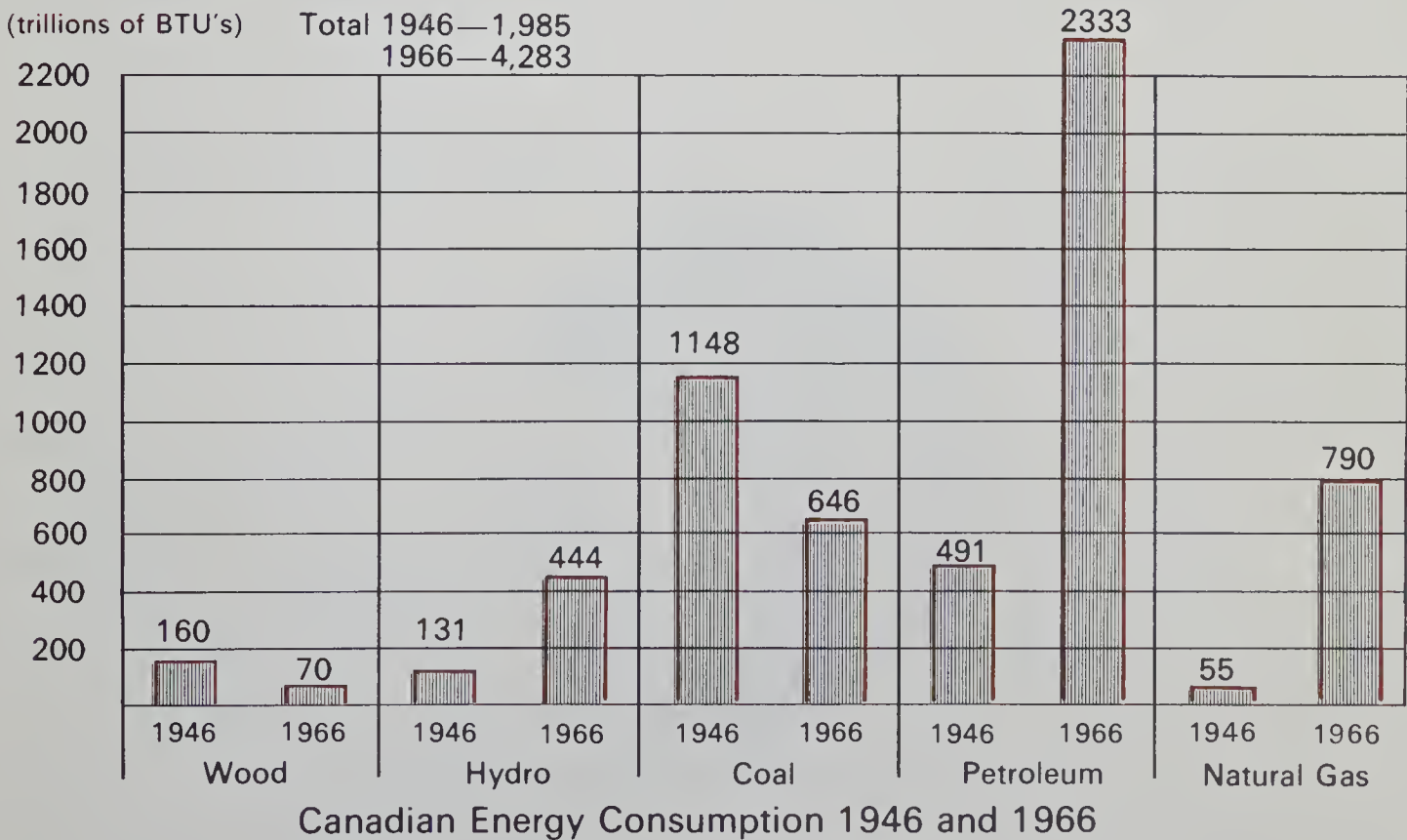
For thousands of years man has done his work largely through his own muscles or the use of animals such as horses or oxen.

Energy is the amount and kind of power man uses to do his work.

Can you think of some types of energy which man has developed to move heavy objects and to do other types of work?

Figure 48 shows some of the major kinds of energy used in Canada.

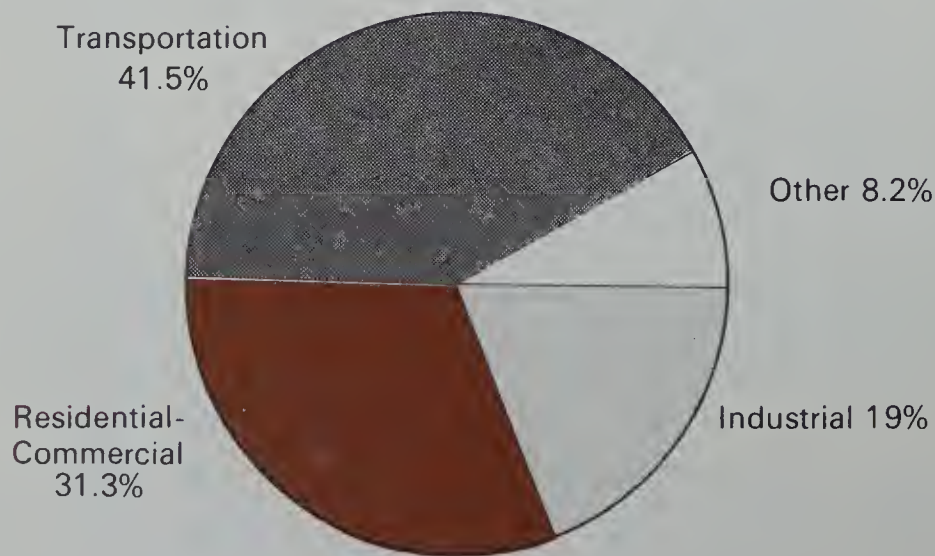
Figure 48



Exercise

1.
What kinds of energy are being used less in 1966 than in 1946?
2.
What kinds of energy are being used more in 1966 than in 1946?
3.
What form of energy makes up more than half the total of all energy used in 1966 (use just the numbers shown and do not worry about the trillions):
4.
Why do you think petroleum and natural gas are being used more and coal and wood less?
5.
What generalizations can you make about

Figure 49



Uses of Petroleum Products in Canada

the use of kinds of energy in Canada at this time?

Oil and natural gas are often found together and we shall learn more about this in the next unit. Did you know that the average Canadian uses more petroleum products than people from any other country in the world? Can you think of some reasons for this? Would our climate have anything to do with it? What about the size of Canada in comparison with many other countries? (The average Canadian uses 775 gallons per year as against 756 for the average American.) Every day in Canada well over a million barrels of oil are used. There are millions of cars, trucks, homes and many thousands of tractors and farm machines which need oil and other petroleum products.

Figure 49 is a pie chart and shows some of the different ways petroleum products are

used to make life more comfortable and work easier in Canada. Does the use of petroleum cause any problems in Canada?

Exercise

1.

What is the major use of petroleum products in Canada?

2.

What are some forms of transportation that would use petroleum products?

In this unit we have been finding out about oil's importance and use in Canada. People who use any product or service are called *consumers*. Figure 50 is a chart showing how much oil was consumed each day in the years 1946, 1956, and 1966 and how much oil is produced each day in different parts of Canada.

Figure 50

Exercise

1.

Which areas of Canada produce the most oil?

2.

Which areas produce the least oil?

3.

Which two provinces use the most oil daily? Approximately how much oil do they use daily?

4.

About how many times more oil is produced than is used in the prairie provinces?

5.

What do you think the prairie provinces do with the extra oil?

Oil Consumption and Production in Canada, 1946, 1956, and 1966

Province	Barrels (per day)			Production (1967)
	1946	1956	1966	
BRITISH COLUMBIA	29,000	78,000	115,000	54,000
PRAIRIE PROVINCES	43,000	154,000	198,000	902,000*
ONTARIO	78,000	242,000	409,000	3,400
QUEBEC	53,000	181,000	360,000	—
ATLANTIC PROVINCES	19,000	64,000	132,000	24
TOTAL	222,000	719,000	1,214,000	960,000 (rounded)

(*includes NWT—2000 barrels per day)

6.

Did Canada in 1966 produce enough oil for its daily needs?

7.

What does your answer for question 6 mean for Canada?

These questions might be used to start a general class discussion.

8.

What would be some of the consequences if Canada's oil supply ran out?

9.

Prepare a report with pictures to show either — The Importance of Oil for Canada or — The Problems of the Oil Industry.

VI: What is Oil and Where is it Found?

We do not really know how oil came into being. Scientists have an explanation or a theory which they think is an answer to the question.

Scientists believe that millions of years ago little sea animals died and sank to the bottom of the seas. During different periods, seas covered large areas of what are now land surfaces.

For millions of years these little animals continued to be buried in the layers of sediment lime, mud, and sand, which were being deposited in the seas. As the total thickness of these layers or *strata* increased, there was tremendous pressure on the deeper layers. Any fluid such as water or petroleum substances, was squeezed out and the sediments were compacted into rocks. Billions of droplets of oil and bubbles of gas accumulated to form large quantities of *crude oil* and *natural gas*. The crude oil is also known as *petroleum*. The word petroleum comes from two words in the Latin language — *petra* meaning rock (do you know of a boy's name similar to this word?) and *oleum* meaning oil — so that petroleum literally means rock oil.

Look at Figures 51 and 52 which try to show how oil was formed.

Exercise

1.

What changes have taken place in the mountains between Figures 51 and 52? What do you think happened to the mountains?

2.

What has happened to the sea in Figure 52 and what has become of the deposit of sea animals?

3.

Where do you think the sedimentary layers came from?

The most logical places to explore for oil or gas are in areas of thick accumulations of *sedimentary* rocks. Even after compaction has taken place spaces may remain between the particles which make up the rock. These spaces are known as *pores* and contain either salt water, crude oil or natural gas. If you filled up a basket with ping-pong balls, there would always be spaces between the balls. Because the particles that make up the sedimentary rock are not all perfectly round like ping-pong balls, the pore space or *porosity* will vary from a very small amount up to approximately one-third of the volume.

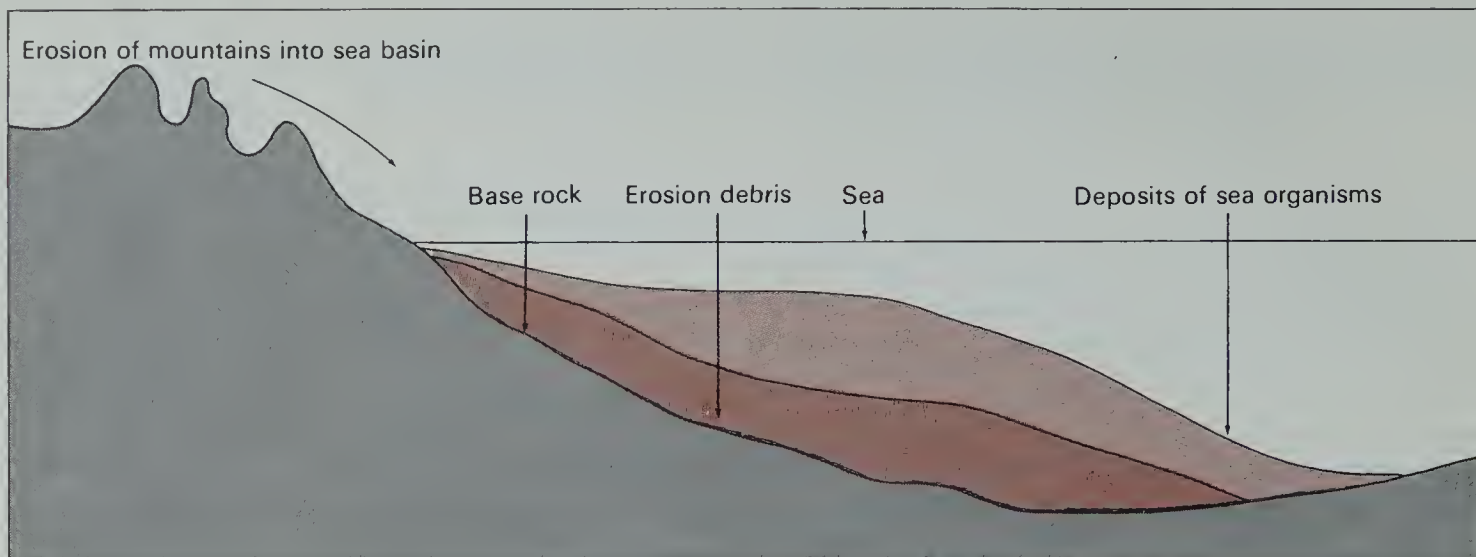
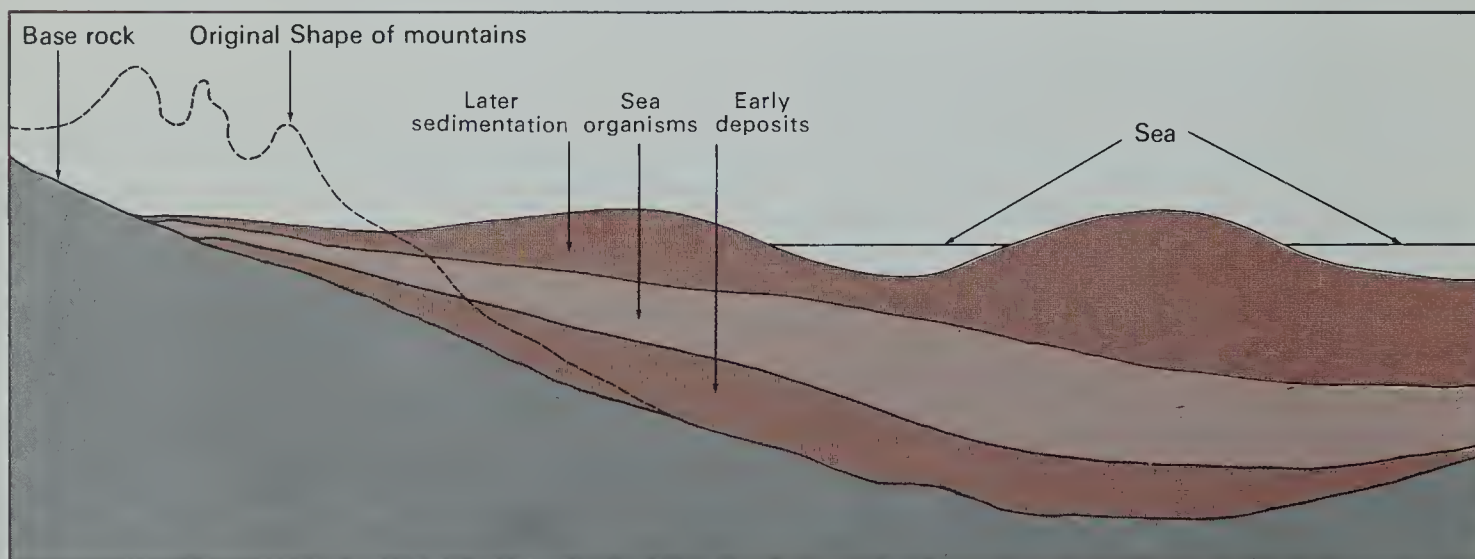


Figure 51

Figure 52



To enable fluids to move through the rock it must also be *permeable*. This means that each little pore space must be connected to another pore space. Just as you could move freely from one room to another in a building where all the doors were open. However, if someone locked you in a room, you would

be trapped in that one room and would not be able to move anywhere. Where there is no connection between the pore spaces, the rock is said to be *impermeable* or *impervious*.

When movement of fluids through a *porous* strata is blocked by rock which is



Figure 53

impermeable the gas and oil will move to the highest part of the porous rock and accumulate. The oil is said to be trapped and is known as an oil or gas *reservoir* sometimes called a *pool*.

Natural gas is contained in the oil much as the gas in a bottle of pop, or it may form as a separate accumulation above the oil, in which case it is known as a *gas cap*. Gas can also accumulate above water with no oil present.

Changes are continually taking place in the earth's crust and over millions of years strata which were laid down in a relatively flat position have been tilted, folded, and thrust up into mountains. Such activity has resulted in the formation of *traps*. Traps may also be formed by organisms in the sea which build *reefs*. Ancient reefs formed millions of years ago act as traps for most of the oil found in what is today the Province of Alberta.

In some areas *oil-seeps* or *tar-pits* are

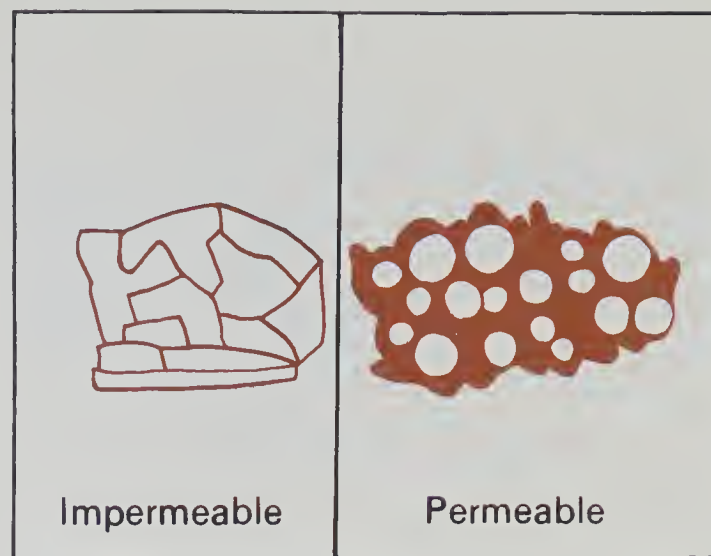
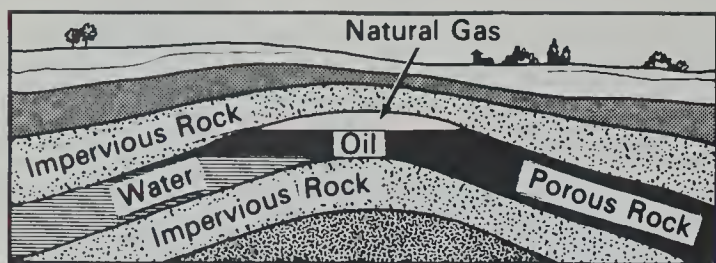


Figure 54

known to exist. This occurs where *faults* or cracks in the earth's crust have permitted oil to leak to the surface.

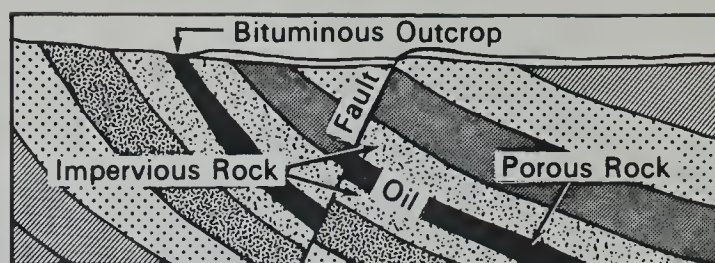
Exercise

1. From looking at Figures 55 and 58 what generalization could you make about how gas, oil, and water tend to be arranged?
2. Could you guess why this might be so? (Put some oil in a glass of water and observe what happens. Could you try this with several types of oil and arrive at an hypothesis?)
3. In what kind of area do you think faults would tend to be found?
4. What do all of these types of traps have in common?



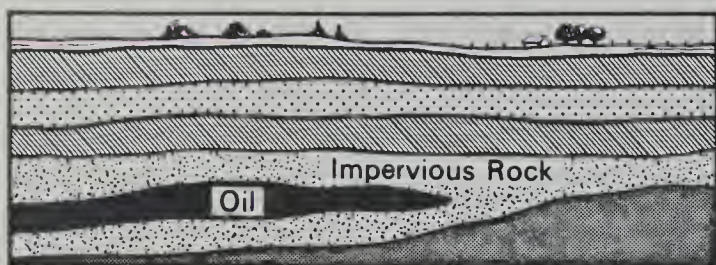
THE ANTICLINE OR DOME
OIL AND GAS TRAP

Figure 55



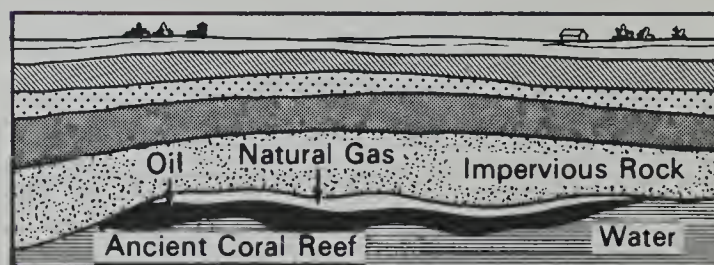
THE FAULT TRAP

Figure 56



THE STRATIGRAPHIC TRAP

Figure 57



THE REEF OIL AND/OR GAS TRAP

Figure 58

5.

Why are they called traps?

6.

What would happen do you think if there were no overlay of impervious rock?

Figure 59 is a map showing the major oil and gas fields of Alberta and the kinds of traps making up some of these fields.

What would be the type of trap found in the Swan Hills field?

Exploring for Oil

Before oil can be drilled by someone like Mr. Farrar or transported through pipelines by someone like Mr. Verner, there must be people trained to explore the earth's crust and discover where the oil is. Now we will discuss where and how oil can be found.

Early in the history of the oil industry certain rock structures caused by the folding of the earth's surface were recognized as

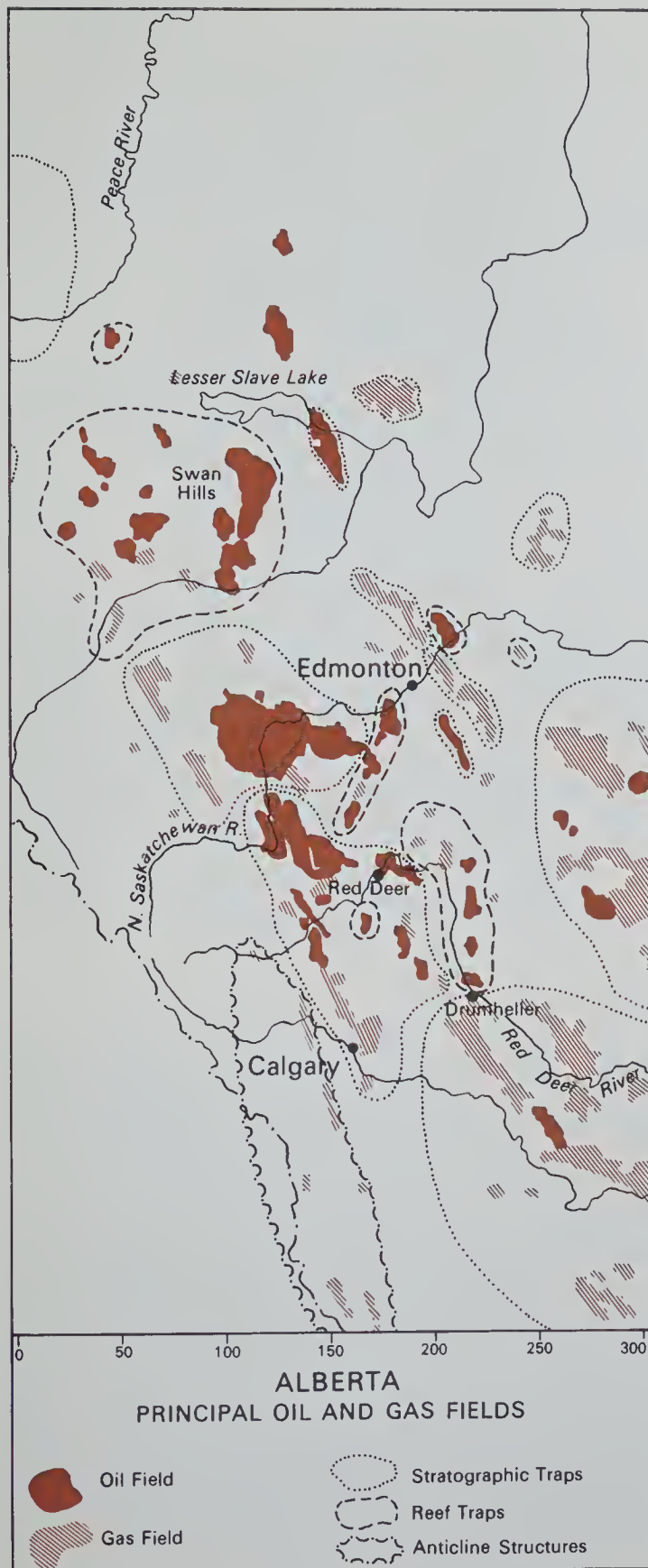


Figure 59

the best places to look for oil. Many of these structures were easily recognized at the surface and this resulted in the discovery of numerous large oil and gas fields. After all the obvious surfaces had been drilled, it became necessary to look for the hidden ones. Exploring for something you can't see is much more difficult.

Exercise

1. What are some ways you can explore for something you can't see?
2. Look up the words *geologist* and *geophysicist* in your dictionary. What do these people do? In what ways is their work similar? In what ways is it different?
3. To make this clearer, which one gets information from studying rocks? Which one develops special tools and techniques to get a picture of the strata below the surface of the earth?
4. Why are both needed in the oil industry especially in the plains of Alberta?

Tools and Equipment Used

The geologist and the geophysicist work closely together in *subsurface geology*. In

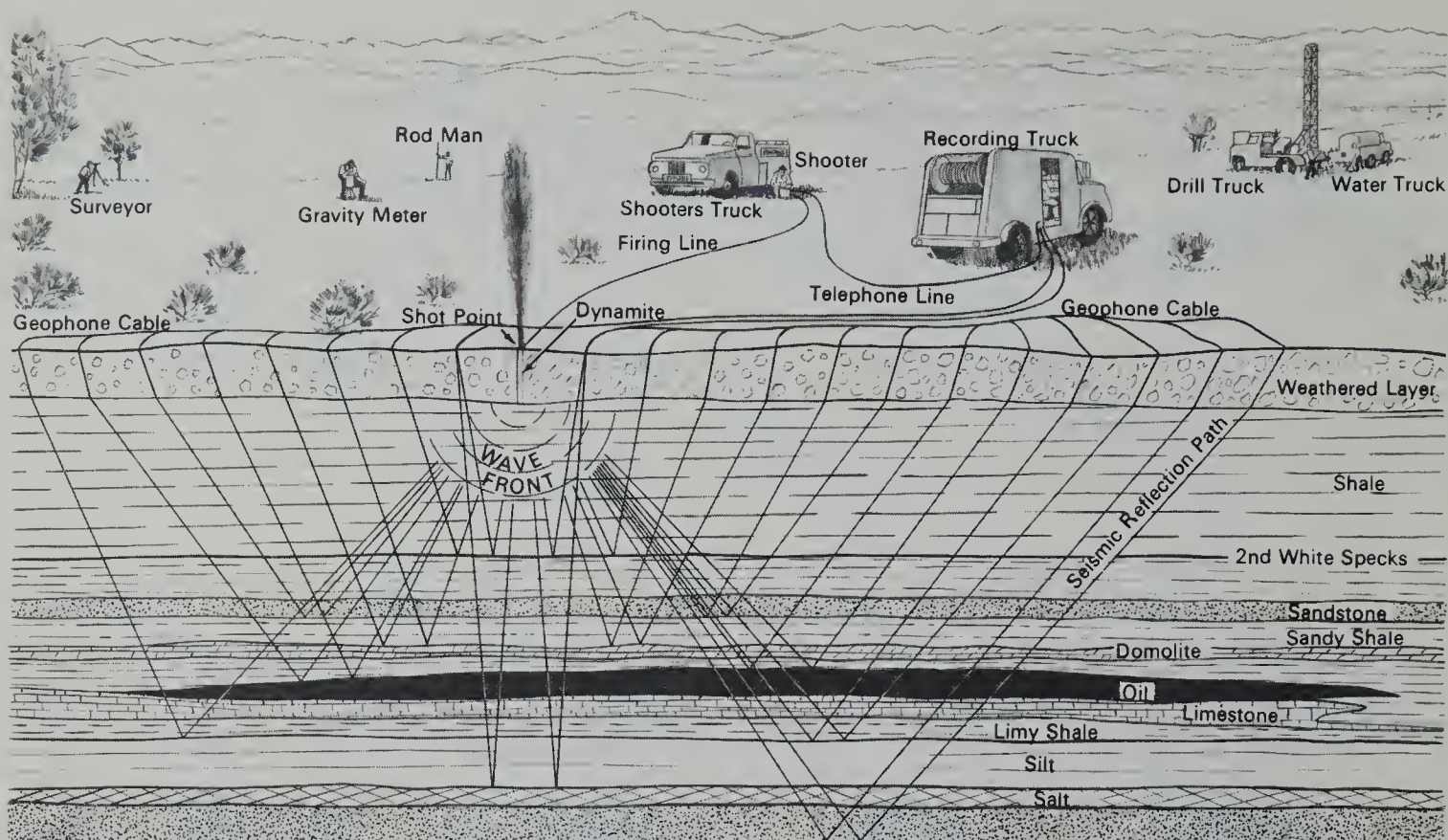


Figure 60

the last question if you guessed that the plains of Alberta have little exposed rock strata, you would be correct. The geologists must make predictions of what things are like far below the surface. Look at Figure 60 which shows some of the tools and equipment used by a geophysical crew to get information.

Look at Figure 61. Can you describe what you see in the photo? This is called a core sample. When these pieces are brought up to the surface, they are put in boxes in the exact order the pieces of core had been in

when they were in the ground. What sort of *evidence* is this for the geologist?

In studying the core, he is interested in the type of rock; the *fossil* content or remains of animals that lived at the time when the rock was being deposited and whether there is any porosity in the rock. What conclusions could the geologist draw from examining a piece of core?

Do you know what a fossil is? Can you find some fossils where you live? Look at Figure 63 for an idea of what some fossils are believed to have looked like.

Figure 61



Figure 62



MINUTE MARINE LIFE

Figure 63

VII: How Representative is Home Oil?

What Does Representative Mean?

We have in this book studied only one of the many oil companies in Canada. What we would like to do in this unit is find out how Home Oil is like other oil companies in Canada and if it is different in some ways.

Look up the word *representative* in your dictionary. (If you can — read pages 53 to 55 in G. de Leeuw's *Manitoba Lowlands*, Holt, Rinehart & Winston, 1967.)

Look at the drawing of the five glasses below:

If you were to pick a *representative* or typical glass which one(s) would you pick? Would number three be the most representative or typical? Why or why not? Which would you pick? Why?

By now, you are beginning to get an idea of what we mean by representative. That is — not being different from other samples in any important fashion. For example, who in your room would be a representative girl or boy — one who is about the average age,

Figure 64



height, hair colour, eye colour, etc.? What would be a representative kind of house on your block? Which gas station? Could the class come up with some things — like grocery stores, singers, cars, etc. — which they would like to compare in ways in which they are alike and ways in which they are different? What would be the things that a representative or typical store, singer, car or anything else might have?

How is Home Oil Like Other Oil Companies?

Home Oil is like other oil companies in a number of ways. All oil companies in Canada need to get the right to look for oil on land belonging originally to someone else. All of the companies use scientists such as geologists and geophysicists to try to find out if oil might be at a certain place. The exploring and drilling for oil for most companies is pretty much the same — of course the place where one looks is important — exploring for oil in the ocean or the mountains can be different from exploring for oil on the prairies.

In short, in looking for oil — in drilling for oil — in producing oil — Home Oil does about the same thing that other oil companies in the Canadian West do.

How is Home Oil Different from Other Oil Companies?

One big difference or unrepresentative thing about Home Oil is that it is a largely Canadian owned oil company. Most of the big oil companies are owned by people out-

side of Canada — mostly American but also British, Dutch and others*

Though Home is an important company in the oil business it is not as big as some other companies. Below are some figures about the daily crude oil production in Canada and Home's daily production.

Daily Oil Production (in barrels per day)

	<i>Home Oil</i>	<i>Canada</i>
1966	11,500	347,600
1967	12,000	414,700

If you were to divide Home Oil's daily production into Canada's daily production what part of Canada's total production would Home Oil's production be?

Home is different in some other ways. When you and your family go out for a drive and need to buy gas what are some of the kinds of gas you can buy? Is Home one of them? Shell, Esso, and Gulf are also major oil companies — do these names sound familiar when your father needs to buy gas? How might Home be different from Shell, Esso and Gulf?

Home is different in other ways. Many of the very large companies own their own refineries. In the Province of Alberta there are some seven oil refineries — owned by Gulf, Husky, Imperial Esso, Shell, and Texaco. There are many oil companies in Alberta but only five own refineries. Would owning a refinery by any oil company be representative? Why or why not?

Conclusion

In exploring and producing and transporting

*Despite recent uncertainty about its future, Home Oil's ownership remains Canadian. (Consumer's Gas Co.)

oil Home is like other oil companies in Canada. It is very different from companies which produce most of Canada's oil in that it is mostly owned by people from Canada. It is different from companies that produce most of Canada's oil in that it does not sell gasoline as do some of the very big com-

panies. It does not, like some of the very large companies, have its own refineries. Home Oil is not, however, an unimportant company — it holds leases on many millions of acres — which if oil is found will make Home a very big oil company.

VIII: Notes for the Teacher

The following are some of the major concepts and generalizations that this book is intended to develop.

Exploration

1. Oil companies need a great deal of money, people with many different skills, land rights, tools, and other resources.
2. Mineral rights beneath the ground, including oil and gas, tend to be owned by the provinces in the West.
3. Provinces *lease* mineral rights to oil companies and collect *royalties*.
4. Many wells drilled for oil are dry holes or have little oil.
5. Searching for oil is a high risk business.
6. Oil is often found far from settled areas.
7. Oil companies must often build roads, airfields, and whole towns.
8. Many men with different kinds of knowledge help to look for oil.
9. Many men with different kinds of knowledge help to decide to drill or not drill for oil in a certain area.
10. Men with different kinds of knowledge and skill are needed to drill a well.

11. All drilling is on a twenty-four-hour basis.

12. Bore holes can go from a few hundred feet to as much as five miles into the ground.

13. Modern drilling rigs are of the rotary type rather than the cable tool type.

Production and Transportation

14. Productive wells can be produced by natural flow or are pumped to the surface.

15. A separator separates oil.

16. Crude oil is kept for a while in storage tanks.

17. Few men are needed to watch over many producing wells.

18. Pipelines are the primary means of transportation for oil in Canada.

19. Most Alberta pipelines go to or come from Edmonton.

20. Edmonton is the major refining centre of Alberta.

21. Calgary is the headquarters of many oil companies in Canada.

22. Calgary and Edmonton are two of the fastest growing cities in Canada.

23. Oil companies often operate in many countries — we describe the oil business as being very *international* .

24. Pipelines carry oil and gas from where they are produced to refineries.

25. Many new pipelines have been built in Canada in the past thirty years.

26. Pipelines are very costly to build but very cheap to use.

27. The modern oil business is so complicated that no one man can know all about it.

28. In modern businesses, such as the oil industry, men need information and help from others.

29. No one man knows enough to make all of the decisions in the oil industry without the help of others.

30. People depend a great deal on other people in modern societies — they are highly *interdependent*.

Consumption of Petroleum Products in Canada

31. Wood and coal are used less for energy sources today than they were twenty years ago.

32. Petroleum, natural gas, and hydroelectricity are used more today than they were twenty years ago.

33. Transportation is the major user of petroleum products.

34. Homes and businesses are the second major users of petroleum products.

35. Industries and factories are the third major users of petroleum products.

36. The Western Provinces — especially Alberta — produce most of Canada's oil.

37. The provinces east of Manitoba produce little or no oil.

38. The Eastern Provinces are the major consumers of oil.

Origins and Location of Oil

39. A *theory* is an attempt to explain how things happen or why things happen. There may be some evidence to support it but not enough to be certain.

40. Oil tends to be found in areas of sedimentary type rock.

41. Fossils provide clues as to the presence of oil.

42. Scientists theorize that oil was formed from decaying animal and plant life millions of years ago.

43. Oil and gas are found above water when all three are present.

44. Oil is often trapped in porous rock and held in place by impervious rock.

45. Oil and gas are often found together though the two may be found in separate locations.

Representativeness

1. Home Oil is representative of other companies in the methods of exploration or production that it uses.

2. Home Oil is unrepresentative in that it is a Canadian company, and it does not own a refinery nor does it market gasoline.

Sources of Free and Inexpensive Materials

Company or Agency

Alberta Division
Canadian Petroleum Association
330 - 9th Ave. S.W.
Calgary, Alberta

American Petroleum Institute
300 Corrigan Tower Bldg.
Dallas 1, Texas, U.S.A.

American Petroleum Institute
1271 Avenue of the Americas
New York, N.Y. 10020, U.S.A.
Bank of Montreal
Oil and Gas Dept.
140 - 8th Ave. W.
Calgary, Alberta

Gulf Oil Canada Ltd.
Public Relations Dept.
800 Bay St.
Toronto, Ont.

British Columbia Division
Canadian Petroleum Association
535 Yarrow Bldg.
645 Fort Street
Victoria, B.C.

Bureau of Publication
Govt. of Saskatchewan
Govt. Administration Bldg.
Regina, Sask.

Canadian Association of Oilwell Drilling
Contractors (C.A.O.D.C.)
500 - 816 7th Ave. S.W.
Calgary, Alberta

Canadian Hydrographic Service
Marine Sciences Branch
Dept. of Mines and Technical Services
Ottawa, Canada

Canadian Imperial Bank of Commerce
Petroleum and Natural Gas Dept.
309 - 8th Ave. S.W.
Calgary, Alta.

Canadian Petroleum Association
807 Commonwealth Bldg.
77 Metcalfe Street
Ottawa, Ont.

Department of Mines and Minerals
Government of the Province of Alberta
Edmonton, Alta.

Home Oil Co. Ltd.
304 - 6th Ave. S.W.
Calgary, Alberta

Imperial Oil Ltd.
500 - 6th Ave. S.W.
Calgary, Alberta

Shell Canada Limited
1. Box 400, Terminal A, Toronto, Ont.
2. Box 430, Station B, Montreal, Que.
3. Box 2211, Vancouver, B.C.
4. Box 100, Calgary, Alta.

Saskatchewan Division
Canadian Petroleum Association
901 McCallum Hill Bldg.
1874 Scarth Ave.
Regina, Sask.

Materials

Oil and Gas in Alberta
1967 Statistical Yearbook (\$5.00)

Primer of Oil and Gas Production

Facts About Oil

Oil and Gas Map of Canada
A Guide for Oil and Gas Operators in Canada

Oil: The Saga of Modern Transportation
Exploring for Oil

Oil and Gas in British Columbia
Oil in Saskatchewan (for the
Dept. of Mineral Resources)

An Introduction to Drilling

Submarine Pipelines in the Western
Arctic by T. D. W. McCulloch

Annual Map Review of Canadian Oil
and Natural Gas Developments

Alberta Oil and Gas Picture: 1947-1967

Review of Petroleum and Natural Gas Legislation
and Surface Rights Procedures:
Western Canada

The Story of Petroleum
Refineries of Shell Canada, Ltd.
Sulphur
The Oil Venture

(Also write to provincial departments of Mines and Minerals or Energy and Resources — B.C., Manitoba, Ontario, Que., and New Brunswick; the National Energy Board, Ottawa; The Gas and Petroleum Association of Ontario; and the Department of Northern Affairs and Natural Resources, Ottawa, Ont.)

Books and Magazines

Ball, Max W. *This Fascinating Oil Business*, Bobbs-Merill Co.

Cookerbob, Leslie Jr. *Crude Oil Pipelines and Competition in the Oil Industry*, Harvard University Press, Cambridge, Mass., 1955.

Oilweek, 805 - 8th Ave. S.W., Calgary, Alta.

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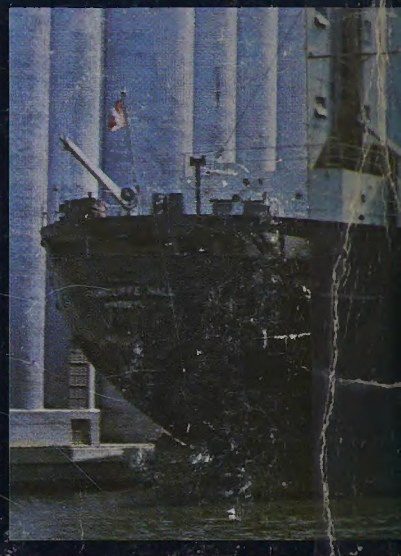
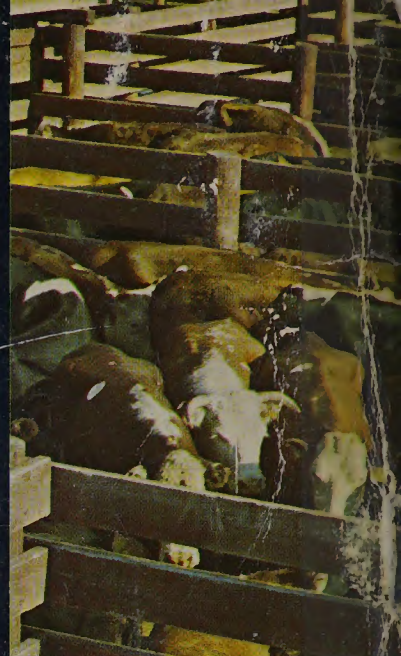
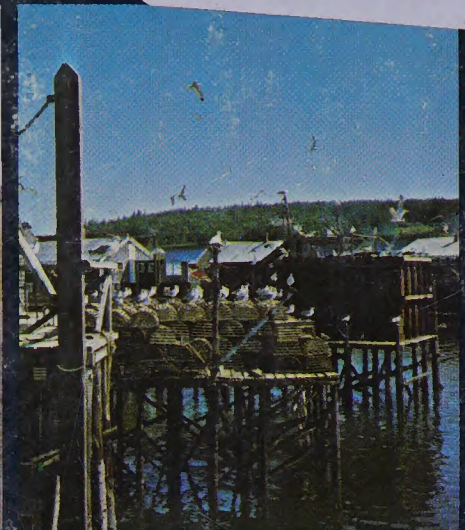
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